7 Resource Analyses

The analyses in this chapter are based on the selection of specific water sources for flow augmentation (see chapter 5) and should be considered representative rather than definitive for the flow augmentation scenarios. Selection of water sources from other subbasins would result in environmental effects in other areas. However, the magnitude of effects is likely to be similar regardless of the subbasin or water sources selected.

This chapter discusses the affected environment and the projected environmental consequences of the scenarios. Discussion of the affected environment is not meant to be all encompassing but is limited to those physical areas that would be affected by a flow augmentation scenario. The reader is directed to Reclamation (1996a and 1997a) for descriptions of Snake River tributary basins not fully covered in this analysis.

Native Americans frequently find descriptions of natural resources to be too narrow. They view their entire heritage, including beliefs, traditions, customs, and spiritual relationship to the earth and natural resources as sacred cultural resources. Natural resources are viewed holistically, not as separate components. Reclamation acknowledges this view point, but for the sake of analysis has evaluated natural resource components separately. Relationships between resources are identified where possible.

This chapter is divided into the following major sections:

- Water quality
- Fish
- Wildlife and Vegetation, Including Wetlands and Riparian Habitat
- Threatened and Endangered (T&E) species (listed under the ESA)
- Cultural Resources
- Indian Trust Assets
- Recreation
- Wild and Scenic Rivers

An additional section–state rare species–was considered, but dropped from this analysis. Several states comprising the Snake River basin have identified species of concern. These species are quite numerous, widely scattered, and selected under different criteria by each state (see Reclamation, 1998). For this analysis, Reclamation determined that discussion of federally listed threatened and endangered species would be sufficient to illustrate the potential effects of the flow augmentation scenarios. This same approach has been adopted with respect to Federal Wild and Scenic Rivers versus rivers which fall under state protection. Only Federal Wild and Scenic River designations are addressed in this analysis.

Each major section is further subdivided into (1) a subsection on the affected environment that includes current conditions and (2) a subsection on the environmental consequences or the effects projected to occur with each scenario. Because effects are highly specific to river reaches and reservoirs, each section on affected environment and environmental consequences is usually subdivided into sections based on stream reaches and reservoirs. For this analysis, discussion under the Affected Environment sections constitutes current conditions (Base Case). Thus, the Environmental Consequences sections are confined to the No Augmentation, the 1427i, and the 1424r scenarios. Preliminary analysis of the effects of the No Augmentation scenario were determined to be not measurably different from the Base Case for some categories of analysis. In these categories, the No Augmentation scenario was assumed to be the same as the Base Case and no further analysis was made. Where applicable, effects of the scenarios are presented in a single graphic form or in a single table so that comparisons are readily evident.

The level of detail in the analysis of each resource varies from qualitative to quantitative depending upon available information. To facilitate the development of this data within the time constraints for study completion, Reclamation based much of the analysis on information developed through its ongoing SR^3 program which covers the Snake River basin upstream of Brownlee Dam. Since the geographic extent of this flow augmentation analysis extends to Lower Granite Lake, there is a difference in the geographic scope. Information about the basin between Brownlee Dam and Lower Granite Dam is not presented at an equivalent level of detail as the SR^3 area. However, the areas of greatest potential impact of the four scenarios is in the SR^3 area.

7.1 Water Quality

The Clean Water Act (CWA) was enacted with the objective of identifying water quality problems and setting water quality standards throughout the Nation. The EPA is the Federal agency charged with implementing provisions of the CWA and subsequent amendments. In response, the EPA directed the states to develop water quality programs to assess water quality and to identify stream reaches and lakes that would not support fish and swimming.

Water quality goals have been identified on a national level pursuant to the 1998 Clean Water Action Plan, identifying water quality standards to meet these goals. These water quality standards are based on the requirements for a healthy aquatic biota and for full body contact recreation which typically require the highest instream and reservoir water quality to achieve fishable and swimmable waters for all Americans.

Water quality is an important issue to Native Americans as all life - - plant and animal - - depends on abundant, clean water. Water quality which negatively affects aquatic life, would have a negative effect on Native Americans. Declining water quality affects not only the abundance and health of aquatic life, but would be perceived as an ecosystem that is out of balance.

Water quality factors critical to meeting national water quality goals include: water temperature, nutrients, dissolved oxygen (DO), bacteria and pathogens, and toxic substances. Instream flows directly affect water quality by increasing or decreasing (diluting) the concentration of nutrients, bacteria, pathogens, and toxic substances. Flow rates can also affect DO, i.e., the greater the turbulence, the greater the DO and temperatures. Reservoir levels impact water quality not only within the reservoir, but downstream when releases are made.

The water quality of Reclamation reservoirs and the downstream reaches that may be affected are included in the compilation of Section 303 (d) of the CWA. A listing by hydrologic unit codes (HUC) originally developed by the U.S. Geological Service (USGS) and further subdivided by prominent landmarks or towns is included as attachment G.

The furthest upstream reaches where there is little development or human influence tend to have little or no water quality problems. Water quality problems tend to increase downstream as streams flow through irrigated areas and other developments and include not only introduced substances but also temperature increases and flow changes or fluctuations that may have adverse effects on aquatic organisms. Sediments, high temperature, bacteria, and low DO have the greatest impact on water quality within the basin.

The following discussion is limited to those reservoirs and river reaches that would be affected by the flow augmentation scenarios. For this analysis, threshold minimum reservoir pools and minimum

streamflows at which significant adverse water quality problems can be expected were obtained from existing reports covering Reclamation facilities within these reaches (see references).

Riverflow in cubic feet per second and end-of-month reservoir content in acre-feet from the hydrologic model were compared to the threshold minimums to determine changes in water quality. The number of instances which fell below threshold minimums was counted for each scenario. The percentage of time these minimums were met or exceeded was calculated and compared to the Base Case scenario and positive and/or negative impacts to water quality were determined.

The BETTER (Box Exchange Transport Temperature Ecology Reservoir) water quality model provided a two-dimensional simulation of dissolved oxygen levels in Cascade Reservoir. These levels were correlated to IDFG reports on winter fish kill to determine how the augmentation scenarios would impact water quality and the fishery in Cascade Reservoir. This is the only reservoir in the Snake River basin for which the BETTER water quality model was used.

7.1.1 Snake River Basin Upstream of Milner Dam

7.1.1.1 Affected Environment–Base Case Scenario

Jackson Lake, the reach from Jackson Lake to Palisades Reservoir, and Palisades Reservoir currently meet the water quality standards. However, flow levels in the Snake River downstream of Palisades Dam to Heise are at times harmful to some aquatic organisms. Peak flows for this reach of the Snake River occur in June and July; low flows, which typically exceed 1,000 cfs, occur in November and December. Further downstream, from Heise to the confluence with the Henrys Fork, water quality standards are met.

Sediment discharge at American Falls Dam reduces downstream water quality whenever reservoir content falls below 50,000 acre-feet (based on sediment and turbidity samples collected during the 1994 drawdown). This is projected to occur in 5 years of the 62-year period of record or 7 percent of the time under the Base Case. Critical months of low reservoir volumes most often occur between July and October.

7.1.1.2 Environmental Consequences

7.1.1.2.1 No Augmentation Scenario

Slight changes in the pool volume of Jackson Lake, Palisades Reservoir and Lake Walcott would not be expected to have significant water quality effects.

The water quality of American Falls Reservoir would be improved slightly due to a slight increase in pool volume and this would somewhat decrease the risk of releasing sediment from the reservoir. These slight effects would be difficult to measure.

7.1.1.2.2 1427i Scenario

On average, Jackson Lake content would be about 8 percent less and Palisades Reservoir would be 11 percent less compared to the Base Case. These lower pool volumes would reduce the volume of cold water available for downstream release.

American Falls Reservoir would be drawn down below 50,000 acre-feet about 14 percent of the time. More frequent low reservoir pools would increase sediment discharge which would further impact downstream water quality.

Lake Walcott would not change compared to the Base Case.

7.1.1.2.3 1427r Scenario

Slight changes in the pool volumes of Jackson Lake, Palisades Reservoir, and Lake Walcott would not be expected to have a significant water quality effect. American Falls Reservoir would be drawn down below 50,000 acre-feet 8 percent of the time with some impact on downstream water quality.

7.1.2 Snake River Basin From Milner Dam to Brownlee Dam

7.1.2.1 Affected Environment–Base Case Scenario

In the past, nearly all flows in the Snake River were diverted at Milner Dam during the irrigation season to meet irrigation demands. Under the Base Case, a flow of 1,500 cfs past Milner Dam is maintained nearly to October. Flows are ramped down during the end of September to normal low releases. The Snake River downstream of Milner Dam is heavily impacted by nutrient and sediment loads and flow modifications. Under the FERC license for the Milner Powerplant, a minimum flow of 200 cfs must be released if available; however, under occasional low flow conditions water is not available for releases and there are no flow releases. Drought conditions reduce the capacity of the river to assimilate nutrient loads. Concurrent years of low flow conditions allow sediments to accumulate and facilitate nuisance algal growths. Periods of elevated instream flows are necessary to move accumulated sediment out of this reach of the river.

Between Milner Dam and King Hill, flow of the Snake River is augmented by groundwater flows, agricultural returnflows, tributaries, and geothermal sites. The Thousand Springs area provides an average annual discharge of more than 4,000 cfs.

Snake River flows downstream of King Hill were not considered in the water quality analysis.

7.1.2.2 Environmental Consequences

7.1.2.2.1 No Augmentation

Flows past Milner Dam during the irrigation season would be considerably less due to cessation of upstream releases for flow augmentation. Flows of less than 200 cfs would be experienced more often than with the Base Case, resulting in slightly worse conditions immediately downstream.

7.1.2.2.2 1427i Scenario

Flows past Milner Dam would be greater in most summer months with improved water quality during those months. However, flows past Milner Dam from September to April would allow for more sediments to remain in the river, reducing downstream water quality.

7.1.2.2.3 1427r Scenario

Flows past Milner Dam would be greater in most summer months with improved water quality during that time. Downstream water quality would be improved by an increase in the number of higher flow months which would continually move sediments downstream.

7.1.3 Boise River Basin

7.1.3.1 Affected Environment–Base Case Scenario

The target minimum discharge from Lucky Peak Dam set in agreements with the city of Boise and IDFG is 150 cfs during the nonirrigation season. This target includes 80 cfs from Lucky Peak space to provide flows for water quality and an additional 70 cfs from space reassigned to the IDFG for stream maintenance. This target flow should provide sufficient flow to assimilate discharge from wastewater treatment facilities without negatively impacting downstream water quality. This target may not be met between December and February if severe drought conditions occur. Concurrent years of drought conditions may reduce reservoir volumes to the point that the target flow would not be met prior to December.

7.1.3.2 Environmental Consequences

7.1.3.2.1 No Augmentation Scenario

Slight changes in pool volumes of Anderson Ranch Reservoir, Arrowrock Reservoir, and Lucky Peak Lake would not be expected to have a significant effect on water quality.

7.1.3.2.2 1427i Scenario

Anderson Ranch Reservoir volume would be 12 percent less on average compared to the Base Case. The lower pool elevation would reduce the volume of cold water available for downstream release. Arrowrock Reservoir volume would be 34 percent less on average compared to the Base Case, and the amount of habitat available for fish during periods of ice cover would be reduced. The risk of sluicing sediments downstream would increase. Lucky Peak Lake would have 13 percent less volume on average, reducing available habitat for fish.

Flows past Lucky Peak Dam on the Boise River from December through March would drop below 150 cfs more often than under the other scenarios. During April through August, flows would be consistently higher than the 150 cfs target minimum.

7.1.3.2.3 1427r Scenario

Slight changes in the pool volumes of Anderson Ranch Reservoir and Lucky Peak Lake would not be expected to have a significant effect on water quality. On average, Arrowrock Reservoir volume would be 21 percent larger compared to the Base Case. The increased pool elevations might provide additional fish habitat and reduce the probability of downstream sedimentation and turbidity during dry years.

Flows past Lucky Peak Dam would drop below the 150 cfs target flow during October and November. However, flows would be improved over other scenarios and would exceed the 150 cfs target during December through February. As with the other scenarios, flows would exceed the minimum target during

March through August. The increased flows in the Boise River could help alleviate water quality problems further downstream through dilution of nutrient and bacterial loads.

7.1.4 Payette River Basin

7.1.4.1 Affected Environment–Base Case Scenario

Cascade Reservoir has a target conservation pool of 300,000 acre-feet to reduce the risk of depleting dissolved oxygen during periods of ice cover. At this pool size, it can be expected that 11 percent of the time winter stagnation conditions may last long enough to affect salmonids; however, the reservoir would not become anoxic (Reininger and Horner, 1982). With the fall turnover of reservoir water layers, nutrients that were released from the sediments during anaerobic conditions are mixed throughout the water column providing additional nutrients for nuisance algal growth.

Water quality of the Payette River downstream from Black Canyon Dam is affected by flow volumes. Water quality degradation is typical during low flow periods when irrigation return flows comprise a large portion of lower Payette River flows. This reach was not evaluated quantitatively.

7.1.4.2 Environmental Consequences

Deadwood Reservoir volume would on average be the same for all scenarios; no change in water quality from the Base Case would be expected.

7.1.4.2.1 No Augmentation Scenario

Water quality in Cascade Reservoir would be slightly improved with a slight reservoir content increase; the risk of winter fish kills would be reduced somewhat. Average reservoir content would be slightly higher under the No Augmentation scenario than under the Base Case. Water quality of the Payette River downstream of Black Canyon Dam would improve slightly due to increased flow releases.

7.1.4.2.2 1427i Scenario

Cascade Reservoir would be drawn down below the 300,000-acre-foot conservation pool much more often than under other scenarios. Figure 7-1 summarizes the average end-of-month content of Cascade Reservoir over the 62-year period of record and reflects less winter carryover. With a smaller pool, reservoir turnover should be earlier in the fall and would distribute available nutrients and dissolved oxygen throughout the pool. Increased algal growth would occur; but, the dissolved oxygen levels available in the winter would not increase. A pool of 300,000 acre-feet would have oxygen-limiting conditions approximately 11 percent of the time, and a 200,000-acre-foot pool would have oxygen-limiting conditions approximately 42 percent of the time. The risk of reaching oxygen-limiting conditions in these smaller pools would increase substantially. Salmonid survival is dependent upon temperatures below 69.8 °F (21 °C) and dissolved oxygen greater than 3 mg/L. Figure 7-1 indicates that a 400,000-acre-foot pool would contain about 35,000 acre-feet that would meet these conditions due to anaerobic conditions from August until fall turnover. Figure 7-1 was developed through use of the BETTER water quality model of Cascade Reservoir to demonstrate the change in pool volume available for fish under different operations; 400,000 acre-feet and 200,000 acre-feet. For a more complete discussion of fish, see the Fish section of this chapter. A pool of 200,000 acre-feet would contain only 20,000 acre-feet that would meet these conditions from July through fall turnover.

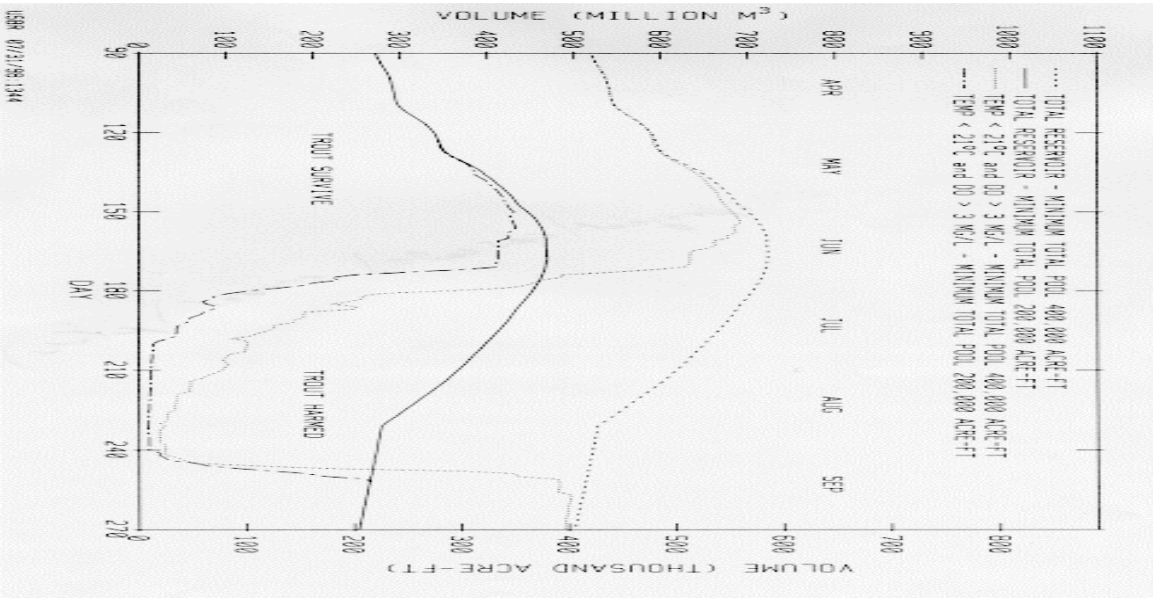

Figure 7-1 Modeled Cascade Reservoir Minimum Trout Habitat During a Low-Water-Supply Year

7.1.4.2.3 1427r Scenario

Under the 1427r scenario, Cascade Reservoir would not be drawn down below the 300,000-acre-foot conservation pool (compared with 5 percent of the time for the Base Case). With a larger winter pool, reservoir turnover would occur later in the fall, allowing greater dissolved oxygen content to be carried further into the winter. The risk of winter fish kill would decrease significantly, and drought conditions would have less effect on the reservoir temperature and dissolved oxygen levels. In contrast, average reservoir content would be somewhat lower compared to the Base Case.

7.1.5 Owyhee River Basin

7.1.5.1 Affected Environment–Base Case Scenario

Most irrigation discharges from Lake Owyhee are released through a diversion tunnel, so downstream releases are limited primarily to meeting instream flow rights for irrigation, which average about 200 cfs. There is no minimum flow requirement below the dam; however, about 15 to 20 cfs is released for instream flow maintenance during the nonirrigation season in good water supply years. Seepage of 3-4 cfs provides the only instream flow below the dam in low water supply years. As a result, dissolved oxygen is limited in the river downstream of Owyhee Dam and varies throughout the river.

7.1.5.2 Environmental Consequences

Lake Owyhee would on average have a volume that was 2 percent less compared to the Base Case; water quality would not be expected to change significantly.

7.1.5.2.1 No Augmentation

The No Augmentation scenario would have no effect on the Owyhee River.

7.1.5.2.2 1427i Scenario

Although the reach upstream of Lake Owyhee was not modeled, acquisition of natural flow rights upstream from Lake Owyhee would clearly increase spring and summer streamflows by decreasing irrigation diversions. Decreased irrigation return flows would reduce the nutrient, bacteria, and sediment concentrations in the river upstream of Lake Owyhee. The amount cannot be quantified.

Lake Owyhee content would be 10 percent less on average compared to the Base Case, but water quality would not be expected to change significantly.

Discharge from Owyhee Dam under the 1427i scenario would continue through the later summer months; therefore, dissolved oxygen levels below the dam would be increased over the Base Case scenario.

7.1.5.2.3 1427r Scenario

The effects on water quality would be same as for the 1427i scenario; Lake Owyhee content would be only 3 percent less on average compared to the Base Case.

7.1.6 Snake River Downstream of Hells Canyon Dam and the Grande Ronde and Salmon Rivers

7.1.6.1 Affected Environment–Base Case Scenario

Tributaries draining into the Snake River between Hells Canyon Dam and Lower Granite Lake are affected by natural water supply, irrigation diversions, and return flows. These stream reaches were not modeled for this analysis.

7.1.6.2 Environmental Consequences

7.1.6.2.1 No Augmentation Scenario

This scenario would have no measurable effect.

7.1.6.2.2 1427i Scenario

Although not modeled, water quality of the Snake River downstream of Hells Canyon Dam would improve due to increased flow. The amount cannot be quantified.
The acquisition of natural flow rights (and reduction of diversions for irrigation) in the Salmon and Grande Ronde River basins would increase streamflows in the spring and summer months and would likely reduce nutrient, sediment, and bacteria concentrations in those streams. The amount cannot be quantified.

7.1.2.1.3 1427r Scenario

The effects on water quality would be the same as for the 1427i scenario.

7.2 Fish

It is important to recognize that rivers and reservoirs within the area of analysis are operated to meet contractual obligations and water rights. Environmental considerations including flows for fish maintenance and propagation are typically secondary to meeting other obligations. In response, fish and wildlife agencies now manage some river reaches for warm water species and non-native species that have replaced cold water and native species. Fish are managed in declining environmental conditions, and any further deterioration of conditions can only add more stress to biotic systems.

In addition to the recreation opportunities that healthy fish populations provide, fish are an important traditional food source for many Native Americans. Native Americans in this region once relied heavily on anadromous fish for food, tradition, and ceremonies. They also utilized fresh water, native fish when available.

Fish of the Snake River basin are comprised predominantly of cold-water species in the families Salmonidae (trout), Cottidae (sculpins), Cyprinidae (minnows), and Catostomidae (suckers). Warm-water species are also present at the lower elevations where warmer water temperatures are encountered.

Aquatic ecosystems and native fish populations have been severely altered by human activities since the mid-1800s. Human alteration of hydrology and water quality by dams, diversions, forestry, ranching, agriculture, mining, municipal uses, and over harvest of fish have caused the extirpation of salmon, decline of native species, and invasion by nonnative fish (Armour et al., 1991; National Research Council, 1992, 1995, 1996; Nehlsen et al., 1991; Sheldon, 1988).

Fish communities in rivers altered by the construction and operation of storage facilities are considerably different from communities found in free-flowing rivers (Reclamation, 1997b) where species diversity or biomass typically increase in downstream reaches and in complex habitats. Fish communities also have a predictable succession from cold-water-tolerant species in the headwaters to warm-water-tolerant species in the lower reaches. Species diversity and community composition in the Snake River basin are segmented by impoundments and low-flow reaches downstream from water diversions. The result is a disjunct distribution of fish communities favoring those species that benefit from or tolerate impoundments, low flows, and other related hydrologic and water quality changes (Maret, 1997). Human influences have changed the aquatic biota from one dominated by native species to the current conditions which favors nonnative species.

The distribution of key nonanadromous salmonids such as bull trout, Yellowstone cutthroat trout, and redband trout has also been reduced. Introduced salmonids, centrarchids, and percids (trout, sunfish, bass and perch) now support most of the sportfishing opportunities throughout the basin. These species tend to be less sensitive to disturbance. Common fish species found under current Snake River basin conditions are listed in table 7-1. More than one-half of these species are not native to the drainage.

Biological requirements of fish include water quality, food, escape cover, passage, and reproduction. Extremes in flows can severely limit or completely remove any or all of the above requirements essential to the survival of fish populations. Reservoir operations may result in substantial drawdown during drought years. Reduced reservoir volume may directly impact the size of the aquatic environment for all organisms in the food chain. When reservoir volume is greatly reduced, bull trout and other fish species may be forced into riverine habitats.

Table 7-1 Common Aquatic Species

Common Name	Species	Origin
Family - Acipenseridae		
White sturgeon	*Acipenser transmontanus*	Native
Family - Catostomidae		
Bluehead sucker	*Catostomus discobolus*	Native
Bridgelip sucker	*Catostomus columbianus*	Native
Largescale sucker	*Catostomus macrocheilus*	Native
Mountain sucker	*Catostomus platyrhynchus*	Native
Utah sucker	*Catostomus ardens*	Native
Family - Centrarchidae		
Black crappie	*Pomoxis nigromachirus*	Introduced
Bluegill	*Lepomis macrochirus*	Introduced
Largemouth bass	*Micropterus salmoides*	Introduced
Pumpkinseed	*Lepomis gibbosus*	Introduced
Smallmouth bass	*Micropterus dolomieui*	Introduced
Warmouth	*Lepomis gulosus*	Introduced
White crappie	*Pomoxis annularis*	Introduced
Family - Cichlidae		
Tilapia	*Tilapia sp.*	Introduced
Family - Cottidae		
Mottled sculpin	*Cottus bairdi*	Native
Paiute sculpin	*Cottus beldingi*	Native
Shorthead sculpin	*Cottus confusus*	Native
Shoshone sculpin	*Cottus greenei*	Native
Torrent sculpin	*Cottus rhotheus*	Native
Wood River sculpin	*Cottus leiopomus*	Native
Family - Cyprinidae		
Carp	*Cyprinus carpio*	Introduced
Chiselmouth	*Acrocheilus alutaceus*	Native
Fathead minnow	*Pimephales promelas*	Introduced
Goldfish	*Carassius auratus*	Introduced
Leatherside chub	*Gila copei*	Native
Leopard dace	*Rhinichthys falcatus*	Native
Longnose dace	*Rhinichthys cataractae*	Native
Northern squawfish	*Ptychocheilus oregonensis*	Native
Peamouth	*Mylocheilus caurinus*	Native
Redside shiner	*Richardsonius balteatus*	Native
Speckled dace	*Rhynichthys osculus*	Native

Table 7-1 Common Aquatic Species		
Common Name	Species	Origin
Tui chub	*Gila bicolor*	Introduced
Utah chub	*Gila atraria*	Native
Family - Ictaluridae		
Black bullhead	*Ameiurus melas*	Introduced
Brown bullhead	*Ameiurus nebulosas*	Introduced
Channel catfish	*Ictalurus punctatus*	Introduced
Flathead catfish	*Pylodictis olivaris*	Introduced
Tadpole madtom	*Noturus gyrinus*	Introduced
Family - Percidae		
Walleye	*Stizostedion vitreum*	Introduced
Yellow perch	*Perca flavescens*	Introduced
Family - Poeciliidae		
Mosquitofish	*Gambusia affinus*	Introduced
Family - Salmonidae		
Atlantic salmon	*Salmo salar*	Introduced
Brook trout	*Salvelinus fontinalis*	Introduced
Brown trout	*Salmo trutta*	Introduced
Bull trout	*Salvelinus confluentus*	Native
Coho salmon	*Oncorhynchus kisutch*	Introduced
Cutthroat trout	*Oncorhynchus clarki sp.*	Introduced/Native
Fall chinook salmon	*Oncorhynchus tshawytscha*	Native
Kokanee salmon	*Oncorhynchus nerka*	Introduced
Lake trout	*Salvelinus namaycush*	Introduced
Mountain whitefish	*Prosopium williamsoni*	Native
Rainbow trout	*Oncorhynchus mykiss sp.*	Introduced/Native

Trout and other salmonids need a relatively stable water flow and a silt-free, rocky substrate for optimal spawning and rearing conditions. Optimal feeding occurs in areas with low water velocity (streamside margins), a plentiful food supply, and escape cover nearby. During winter, rainbow trout and other salmonids tend to move into deeper water or find sufficient cover to avoid damage from ice scouring. Higher, more stable streamflows released during the summer months as a result of flow augmentation would increase aquatic insect production, decrease egg mortality, and increase fish spawning and rearing habitat in various riverine environments.

One of the salmonids most sensitive to habitat degradation and sedimentation is bull trout which was listed in June 1998 by the USFWS as a threatened species.

The relationship of streamflows and reservoir pools to fish populations can be highly variable depending on the exact sequence of events, the length of those events, and the life cycle of the fish. For example

draining a reservoir every 2 years may essentially decimate the fish population and could be just as adverse as draining the reservoir every year, depending on the species of fish and life stage. In addition to the sequence and frequency of drawdown, timing during the year is also important. For example, reservoir drawdown that occurs for only a short period after fish spawn along the shore line may dewater redds and kill the eggs, eventually eliminating the population. Conversely, a greater amount of annual drawdown that leaves a stable pool during the egg incubation period may still provide a good fish population.

For this analysis, streamflow and reservoir pool targets for fish maintenance were identified from a variety of sources. Many of the target streamflows and pool elevations were developed by the fishery Technical Work Group (TWG) as part of the SR^3 program. Others were developed by state fish and game agencies. These target flows and reservoir pool sizes are based on the biological needs of the fish, not operational constraints that may be present in the system. In this analysis, it is assumed that fish populations would be proportionately larger if target flows and target reservoir pools are met more often. However, it is not possible to directly correlate these averages of flows and reservoir pools with fish population changes for the reasons discussed above. Furthermore, the analysis is based on end-of-months reservoir content and average monthly streamflow while the targets are instantaneous targets. Instantaneous values could often be well below the target during a month when the average was well above the target. The analysis in this section is restricted to identifying how often the target minimums or preferred levels are met under each scenario.

The effects of the scenarios are based on the hydrologic analysis (see chapter 5) of reservoir content and riverflows and are expressed as the percentage of time that streamflow and reservoir targets are met. These percentage are based on the number of years a target is met compared to the 62-year period of record.

Unless stated otherwise, minimum streamflows and/or reservoir pools identified in this analysis were developed by the SR^3 fishery TWG based on the biological needs of the fish. These minimum streamflows and reservoir pools do not represent state recognized stream flow minimums or legally protected minimum reservoir levels. In some cases, the fishery developed criteria correlate with operational requirements and/or considerations.

7.2.1 Snake River Basin Upstream of Milner Dam

7.2.1.1 Affected Environment--Base Case Scenario

Most low streamflow problems in the Snake River upstream of Milner Dam occur between October and March when flows at most locations are affected by reservoir refill. Reservoir releases at this time are inversely proportional to the risk of not refilling the reservoir. Overwinter survival of fry may be one of the major limiting factors to trout populations on both the main stem and the Henrys Fork (IDFG, 1992).

7.2.1.1.1 Jackson Lake

Lake trout are the primary fish of concern from a management perspective. The Wyoming Game and Fish Department (WGFD) determined that the critical management period for lake trout is from December through March. Drawdown during this period should not exceed 5 feet to avoid dewatering redds and exposing eggs to adverse conditions such as freezing and drying. This is especially important because the fishery is supported almost entirely by natural recruitment. Drawdown during the critical period does not exceed 5 feet under the Base Case.

7.2.1.1.2 Snake River From Jackson Lake Dam to Palisades Reservoir

Snake River fine-spotted cutthroat trout are the species of concern in this river reach. Low flows present management problems for this reach. Winter releases from Jackson Lake Dam in the past 25 years have often reduced the riverflow to levels that limit the survival of native Snake River cutthroat trout and other organisms (Annear, 1987). WGFD (Annear, 1987) identified a minimum release from Jackson Lake Dam of 280 cfs during the October 1 through March 31 period and a preferred flow release of 400 cfs. March is the most critical month. A maximum release of 600 cfs during the period should not be exceeded as higher releases would be detrimental to the fishery.

7.2.1.1.3 Palisades Reservoir

Palisades Reservoir provided 22,500 angler hours of bank, boat, and ice fishing in 1993. The primary fish caught, 85 percent of which are hatchery fish, is the Snake River fine-spotted cutthroat. Lake trout and kokanee have been introduced, but only small natural populations have developed.

Large fluctuations in the water level (up to 80 vertical feet) may affect the open-water species. Increased outmigration of fish occurs at levels below 500,000 acre-feet (Elle, 1998). Studies have not been conducted to establish a conservation pool for the fishery; however, the SR^3 fishery TWG identified significant fish entrainment likely when levels fall below 500,000 acre-feet. Most of the entrained fish are cutthroat trout which then take up residence in the main stem downstream.

7.2.1.1.4 Snake River Main Stem From Palisades Reservoir to Henrys Fork

The Snake River downstream of Palisades Dam provides a blue-ribbon trout fishery and is becoming an increasingly popular recreation area (Schrader and Griswold, IDFG, 1994). This reach has quality wild Yellowstone cutthroat trout and brown trout fisheries. The stream reach also contains Idaho's most unique riparian ecosystem which includes the largest continuous cottonwood ecosystem in the State. The USFWS considers this stream reach to be the most important fish and wildlife habitat in Idaho.

Cutthroat trout downstream from the dam are a mixture of both fine-spotted and Yellowstone races. Wild, native cutthroat trout supported 90 percent of the catch in the reach below Palisades Dam during 1981. Approximately 25,000 angler days downstream of Palisades Dam produced a catch rate of 0.53 game fish/hour that same year. Brown trout provided only a small portion of the catch (9 percent), but offer the opportunity to catch a trophy fish.

Habitat in this reach is generally in good condition; however, flows do not always support fish needs. Winter releases, regulated to manage Palisades Reservoir storage, have resulted in periodic dewatering of secondary channels and major losses of juvenile salmonids. Dewatering during the late 1980s resulted in reduction of cutthroat populations which temporarily offset gains made through harvest regulation. A multi-agency study completed in 1992 defined a minimum winter streamflow of 1,500 cfs below Palisades Dam and a preferred streamflow of 2,200 cfs between October and March to provide for juvenile salmonid habitat and to prevent important habitat from drying or freezing (Schrader and Griswold, IDFG, 1994). Irrigation releases provide sufficient fish flows the remainder of the year.

Implementation of this minimum winter streamflow was initiated to enhance long-term population stability. This reach was modeled at three separate locations: Irwin, Heise, and Lorenzo.

The hydrologic model of the main stem at Lorenzo indicates that the lower 20 miles are impacted under current operations by low flows and reduced releases from Palisades Dam during the late fall and winter.

7.2.1.1.5 Snake River From Henrys Fork to Idaho Falls

The main stem Snake River from the mouth of the Henrys Fork downstream to the upper Idaho Falls Powerplant produces occasional catches of large rainbow and cutthroat trout. Brown trout are caught in this reach as well. This fishery declined due to silt deposits and loss of habitat after the failure of Teton Dam in 1976 and has improved little in recent years.

Minimum streamflows for fish in this reach of the Snake River were identified by the SR3 fishery TWG and include 3,300 cfs from April through September and 1,650 cfs from October through February. A minimum flow was not identified for March.

7.2.1.1.6 Island Park

Island Park Reservoir is managed for rainbow trout, cutthroat trout, kokanee, Snake River fine spotted cutthroat trout, cutthroat hybrids, among other fish. Rainbow trout and kokanee provide an important reservoir fishery with catch rates of up to 0.6 fish/hour. The fishery has been affected by loss of fish downstream through the dam and by other unknown factors since 1992. The result of these constraints on the Island Park Reservoir fishery has been a decline in catch rates and angler satisfaction.

At Island Park Reservoir, drawdown below 40,000 acre-feet flush significant numbers of fish out of the reservoir (Reclamation, 1998). A preferred pool of 135,000 acre-feet year round is desired to maximize fish production.

7.2.1.1.7 Snake River From Idaho Falls to American Falls

The fishery within this reach consists essentially of a put-and-take hatchery rainbow trout fishery. The hydropower impoundments block upstream migration of spawning brown and cutthroat trout and provide less-productive trout habitat than free-flowing reaches. A minimum year-round flow of 2,000 cfs was identified by the SR3 fishery TWG.

7.2.1.1.8 American Falls Reservoir

American Falls Reservoir has nearly 56,000 surface acres and is a popular fishing reservoir. An estimated 26,000 rainbow trout are harvested during seasons with sufficient water volume (IDFG, 1992). The reservoir is stocked early each spring with catchable-size trout. Growth of these trout is significant. Trout planted in the reservoir migrate downstream annually in midsummer for three reasons: 1) the water temperature in the reservoir becomes too warm, 2) the volume of water in the reservoir may become too low, and 3) the water may lack sufficient oxygen to sustain trout (IDFG, 1992). The reservoir also contains a dense population of nongame fish comprised of suckers, carp, and chubs.

The SR3 fishery TWG identified a minimum year-round reservoir conservation pool of 170,000 acre-feet for fish. A maximum 1,000,000 acre-foot pool for the months of May and June was identified to prevent inundation of trout spawning habitat at upper locations of the reservoir.

7.2.1.1.9 Snake River Downstream of American Falls Dam

The reach immediately downstream of American Falls dam is considered to be a blue-ribbon fishery. Rainbow trout, cutthroat trout, and brown trout are found in this reach.

7.2.1.1.10 Lake Walcott

Lake Walcott is part of the Minidoka National Wildlife Refuge. Fish targeted for management include rainbow trout and cutthroat trout. A minimum reservoir storage of 40,000 acre-feet and a preferred storage of 95,200 acre-feet have been recommended to optimize trout habitat.

7.2.1.2 Environmental Consequences

Release of flow augmentation water would decrease reservoir carryover and reduce annual minimum pools in some years. Reduced pools can lead to increased fish emigration at American Falls, Palisades, and Island Park Reservoirs. Reduced pools and increased fluctuations would reduce total available habitat and fish productivity in affected reservoirs (IDFG, 1992). Additional reservoir drawdowns would affect angler success and access.

Unless stated otherwise, minimum streamflows and reservoir pools identified in this analysis were developed by the SR^3 fishery TWG based on the biological needs of the fish species. These minimum streamflows/reservoir levels do not represent state recognized, legally protected minimum water levels.

7.2.1.2.1 Jackson Lake

The recommendation to limit drawdown to 5 feet or less between December and the end of March would not be met under the No Augmentation, 1427i, or 1427r scenarios; this compares with the Base Case which does meet this recommendation.

7.2.1.2.2 Snake River From Jackson Lake Dam to Palisades Reservoir

Table 7-2 compares how often the recommended winter releases are met or exceeded under the four scenarios. There are slight differences among scenarios with the exception of 1427i which shows a significantly reduced level in the amount of time minimum flows are met during the full period.

Table 7-2 Winter Releases From Jackson Lake Dam (October 1-March 31)

Release	Percent of Time Met or Exceeded			
	Base Case	No Augmentation	1427i	1427r
Minimum: 280 cfs for full period	90	93	84	91
Minimum: 280 cfs for March only	73	71	71	71
Preferred: 400 cfs	43	44	43	43
Maximum: 600 cfs exceeded	26	28	28	29

7.2.1.2.3 Palisades Reservoir

A pool greater than 500,000 acre-feet for the entire year would be maintained at the following percentages for each scenario:

Base Case	95 percent
No Augmentation	97 percent
1427i	86 percent
1427r	97 percent

The 1427i scenario, as compared to the Base Case, would result in lower overall pool levels causing a greater potential for entrainment of fish through the dam. The other scenarios would result in slightly higher pool levels.

7.2.1.2.4 Snake River Main Stem from Palisades Dam to Henrys Fork

Table 7-3 shows how often the minimum and preferred winter streamflows (based on the work by Schrader and Griswold (1994)) would be met. Minimum and preferred streamflows would not be consistently met under any of the scenarios; this limits winter habitat for juvenile cutthroat and brown trout. Minimum streamflows would be met less often at Lorenzo than at Irwin under all four scenarios. The No Augmentation and 1427r scenarios would generally meet the minimum flows at a greater rate than the Base Case; whereas, the 1427i scenario would meet them at a significantly reduced rate.

Table 7-3 Winter Streamflows Downstream of Palisades Dam (October-March).

Streamflow	Percent of Time Met			
	Base Case	No Augmentation	1427i	1427r
Irwin				
Minimum: 1,500 cfs	74	81	67	80
Preferred: 2,200 cfs	64	71	56	68
Heise				
Minimum: 1,500 cfs	79	85	73	84
Preferred: 2,200 cfs	71	79	63	75
Lorenzo				
Minimum: 1,500 cfs	72	79	62	77
Preferred: 2,200 cfs	64	71	55	70

7.2.1.2.5 Snake River From Henrys Fork to Idaho Falls

None of the scenarios would continuously meet the minimum for either of the two identified periods shown in table 7-4. All scenarios would be very similar to the Base Case in meeting the minimum flow recommendations.

Table 7-4 Minimum Streamflow for the Snake River From Henrys Fork to Idaho Falls

Streamflow	Percent of Time Flow is Met or Exceeded			
	Base Case	No Augmentation	1427i	1427r
October through February: 1,650 cfs	88	91	86	91
April through September: 3,300 cfs	89	84	87	85

7.2.1.2.6 Island Park Reservoir

The four scenarios would be roughly equal to the Base Case in ability to meet or exceed the minimum drawdown recommendation of 40,000 acre-feet (93-94 percent of the time) and the preferred recommendation of a 135,000 acre-feet (full pool) (12-13 percent of the time).

7.2.1.2.7 Snake River from Idaho Falls to American Falls

A minimum year-round flow of 2,000 cfs would not be met 100 percent of the time under any of the scenarios. Success in meeting the minimum flow would be:

Base Case	75 percent
No Augmentation	77 percent
1427i	76 percent
1427r	78 percent

All scenarios are very close to the Base Case; however, the 1427i scenario would result in meeting the minimum flow most often in the summer while meeting the minimum less often in the winter compared to other scenarios.

7.2.1.2.8 American Falls Reservoir

The identified conservation pool of 170,000 acre-feet would not be met 100 percent for the entire year under any of the scenarios; however, the Base Case and No Augmentation scenarios would meet this recommendation at a higher rate than the 1427i and 1427r scenarios. The maximum pool recommendation of 1,000,000 acre-feet would be exceeded in both May and June for more than 73 percent of the time under all of the scenarios; the 1427i and 1427r scenarios would exceed the maximum pool less often than the Base Case and No Augmentation scenarios. Exceeding the maximum pool recommendation would cause reservoir water temperatures to rise and could inundate upstream channel habitat allowing non-native fish to access native species spawning and rearing areas. Table 7-5 shows how often the recommended minimum and maximum pools at American Falls Reservoir would met or exceeded.

Table 7-5 Pool Levels at American Falls Reservoir				
Pool	Percent of Time Pool is Exceeded			
	Base Case	No Augmentation	1427i	1427r
Year-round minimum pool met or exceeded: 170,000 acre-feet	90	93	82	87
Months minimum pool met or exceeded 100 percent of time	November-June	November-July	December-June	November-June
Maximum pool exceeded during May: 1 MAF	95	97	81	89
Maximum pool exceeded during June: 1 MAF	82	85	81	73

7.2.1.2.9 Snake River Downstream of American Falls Dam

This reach was not evaluated.

7.2.1.2.10 Lake Walcott

A minimum reservoir storage of 40,000 acre-feet and the preferred storage of 95,200 acre-feet would be met 100 percent of the time under all scenarios; there would be no change from the Base Case.

7.2.2 Snake River Main Stem From Milner Dam to Brownlee Dam

7.2.2.1 Affected Environment–Base Case Scenario

7.2.2.1.1 Snake River From Milner Dam to Buhl

Rainbow trout, cutthroat trout, and mountain whitefish are found in this reach. Trout habitat is good throughout most of the free-flowing reaches. However, lack of flows downstream of Milner Dam, especially during the irrigation season, cause water quality deterioration and result in a loss of spawning habitat which significantly affects fish production.

Minimum flows between Milner Dam and Buhl were determined by the SR^3 fishery TWG. The flows identified for July through September would improve water quality conditions. If the flow recommendations were met, algae beds may decrease, creating an increase in fish habitat and slowing oxygen depletion (IDFG, 1992). Increased summer flows would also scour the substrate and aid in prevention of sediment accumulation. Seasonally stable water levels would increase salmonid spawning and rearing habitat by preventing the dewatering of side channels which are important to sustaining a naturally reproducing fishery.

7.2.2.1.2 Snake River From C.J. Strike Reservoir to Brownlee Reservoir (Flows at C.J. Strike)

The Snake River between Walters Ferry and Brownlee Reservoir flows through a broad, flat, low-gradient plain. The river has few rapids or riffles, but many large islands. This reach supports a diversity of warm-water game species, including smallmouth bass, channel catfish, largemouth bass, crappie, bluegill,

sunfish, and flathead catfish. Rainbow trout, mountain whitefish, and white sturgeon are also found in this reach. Between Swan Falls Dam and Walters Ferry, the Snake River primarily supports smallmouth bass, channel catfish, and white sturgeon.

A 1984 study by IPC and the USFWS evaluated the effects of flow changes on resident fish habitat in the Snake River from C.J. Strike Dam to Brownlee Reservoir. The priority management species through this reach is the native white sturgeon. The biology and habitat requirements of white sturgeon are poorly understood; however, sturgeon have extreme longevity (over 100 years) for fish. Other target species for this analysis included smallmouth bass, channel and flathead catfish, rainbow trout, and mountain whitefish (USFWS, 1992a). An array of desirable flows between C.J. Strike and Brownlee have been recommended to enhance fish habitat.

7.2.2.2 Environmental Consequences

7.2.2.2.1 Snake River From Milner Dam to Buhl

The quality of trout habitat is largely dependent on the rate that minimum flow recommendations are met in this reach. Table 7-6 summarizes the identified recommended flows and the percent of time those flows would be met under the four scenarios. In general, the No Augmentation scenario would meet the recommended flows at a greater rate than the others, followed by the 1427r and Base Case, with 1427i meeting the recommendations at the lowest rate.

Table 7-6 Minimum Flow Identified for the Snake River Between Milner Dam and Buhl

Flow	Percent of Time Flow is Met			
	Base Case	No Augmentation	1427i	1427r
October: 4,850 cfs	31	31	18	21
November: 4,075 cfs	40	52	29	37
December: 3,500 cfs	63	71	55	63
January: 3,250 cfs	54	56	47	53
February: 3,125 cfs	55	58	48	58
March: 4,752 cfs	42	45	40	44
April: 7,227 cfs	34	39	32	34
May: 12,300 cfs	6	6	8	8
June: 13,525 cfs	0	0	0	2
July: 8,400 cfs	2	3	6	6
August: 5,600 cfs	0	0	61	50
September: 5,050 cfs	6	8	0	6

7.2.2.2.2 Snake River From C.J. Strike Reservoir to Brownlee Reservoir (Flows at C.J. Strike)

The identified desirable flows would be met so infrequently that fish benefits (based on habitat needs) would be limited under all scenarios. Table 7-7 summarizes the flows and the frequency that they would

be met under the scenarios. In general, the Base Case and No Augmentation scenarios would be very similar except in December when No Augmentation would less often meet the flow recommendation. The 1427i and 1427r scenarios would meet the recommended flows less often than the other scenarios except in the early summer months.

Table 7-7 Flows of Snake River Between C.J. Strike Reservoir and Brownlee Reservoir

Flow	Percent of Time Flow is Met			
	Base Case	No Augmentation	1427i	1427r
October: 12,500 cfs	34	34	19	23
November: 16,000 cfs	13	10	11	6
December: 16,000 cfs	56	45	31	37
January: 16,000 cfs	18	19	18	18
February: 16,000 cfs	23	16	15	16
March: 16,000 cfs	23	27	27	27
April: 15,000 cfs	37	39	32	35
May: 12,000 cfs	40	37	45	48
June: 9,000 cfs	24	23	45	44
July: 12,500 cfs	6	6	11	10
August: 12,500 cfs	0	0	6	5
September: 12,500 cfs	11	11	2	11

7.2.3 Boise River Basin

7.2.3.1 Affected Environment–Base Case Scenario

7.2.3.1.1 Anderson Ranch Reservoir

Anderson Ranch Reservoir is a popular fishing location within the Boise River basin. This reservoir provides a two-story fishery with smallmouth bass occupying the warm, inshore waters and rainbow trout and kokanee dominating the cold midwater areas (IDFG, 1992). Good spawning conditions in tributary streams provide a continuous supply of kokanee in the reservoir. Recent studies indicate that populations of bull trout in (a species listed as threatened) Anderson Ranch Reservoir migrate up tributary streams annually to spawn and later return to the reservoir. More information on bull trout at Anderson Ranch Reservoir is included under the Threatened and Endangered Species section (7.4).

Maintenance of a year-round conservation pool of at least 70,000 acre-feet in Anderson Ranch Reservoir would protect resident fish habitat within the reservoir (IDFG, 1992). Dropping below this level would likely stress fish by reducing water quality, habitat, food sources, and increasing the water temperature.

7.2.3.1.2 South Fork Boise River

The South Fork Boise River from Anderson Ranch Dam downstream to Arrowrock Reservoir was designated a quality trout stream segment in 1978, the first such designation in southwestern Idaho (IDFG, 1995). Wild rainbow trout, bull trout, and mountain whitefish make up the majority of the fish caught in the South Fork. Anglers caught an estimated 18,400 rainbow trout in 1988 and released 99 percent of the catch (IDFG, 1995).

Minimum flow targets were selected for this reach through consultation with IDFG and interest groups and are outlined in Reclamation's Operations Manual (Reclamation, 1997c). These targets are 300 cfs from September through March and 600 cfs from April through August. The South Fork Boise River fishery benefits from releases during the winter months when flows are low. Maintenance of stable flows of at least 300 cfs increases aquatic insect production, decreases egg mortality, and provides suitable fish spawning and rearing habitat in the South Fork.

7.2.3.1.3 Arrowrock Reservoir

There are two main tributaries to Arrowrock Reservoir, the South and Middle Forks of the Boise River. Arrowrock Dam blocks upstream fish passage and the South Fork is further blocked by Anderson Ranch Dam, 49 river miles upstream of Arrowrock Dam. Arrowrock Reservoir is often severely drawn down by late October as a result of meeting downstream irrigation demands while maintaining Lucky Peak Lake at a high level during the recreation season. Releases from Arrowrock Dam provide nearly all the inflow to Lucky Peak Lake.

Arrowrock Reservoir offers about 3,150 surface acres of fishing at full pool and contains a variety of fish species including smallmouth bass, yellow perch, rainbow trout, bull trout, and mountain whitefish. More information on bull trout at Arrowrock Reservoir is included under Threatened and Endangered Species section (7.4).

Drawdowns and low reservoir levels in the winter negatively impact development of the fish food base, limit spawning conditions for warm-water fish, expose nests, and kill the eggs, reducing the capacity to carry a sport fishery and forcing fish to migrate into Lucky Peak Lake (IDFG, 1992). A conservation pool of 28,700 acre-feet year round has been identified for Arrowrock Reservoir to increase fish habitat and winter carryover of rainbow trout (Wolfin and Ray, 1984).

7.2.3.1.4 Lucky Peak Lake

Lucky Peak Lake provides good habitat for cold-water fish species such as smallmouth bass, yellow perch, rainbow trout, bull trout, kokanee, mountain whitefish, and many nongame species. Spawning conditions for warm-water fish are better in Lucky Peak Lake than in Arrowrock Reservoir because water levels are generally maintained at a constant level throughout the summer (Wolfin and Ray, 1984). The unofficial conservation pool for Lucky Peak Lake is 28,767 acre-feet (Reclamation, 1997c).

7.2.3.1.5 Boise River From Lucky Peak Dam Downstream to Star

The upper reach of the Boise River supports several cold-water fish species. Mountain whitefish is the most abundant game fish present. Hatchery reared rainbow trout, wild rainbow trout, and brown trout comprise the remaining fishery (IDFG, 1992).

Reclamation manages 102,300 acre-feet of storage space in Lucky Peak Lake for minimum streamflows in the Boise River. The use of this storage for purposes other than winter instream flow maintenance would jeopardize the resident fisheries, recreation, and reservoir pools in the entire Boise Project (IDFG, 1992). Low winter flows displace fish, limit winter carryover, and reduce spawning habitat. Lower

winter flows would cause a loss of sufficient cover and deeper water to protect fish from ice scouring, and incubating eggs would be deprived of oxygen and frozen if flows are so low that the river freezes.

Sedimentation has rendered spawning gravels unusable and limits trout reproduction downstream of Lucky Peak Dam. Water-quality problems are worsened under low flow conditions by industrial discharges and sewage treatment plants that discharge effluent directly into the Boise River. Low fall and winter flows reduce habitat quality for fish and aquatic organisms, limiting the winter carryover and growth of game fish.

From Lucky Peak Dam to Glenwood Bridge, the ideal flows for a healthy, productive fishery is bank full. High flushing flows are necessary to move silt and sand from suitable spawning gravels and increase aquatic insect production. The SR3 fishery TWG identified a variety of minimum and preferred streamflows for the Boise River downstream of Lucky Peak Dam.

7.2.3.2 Environmental Consequences

7.2.3.2.1 Anderson Ranch Reservoir

The conservation pool of 70,000 acre-feet would not be maintained for the entire year under any scenario. Success in maintaining the recommended conservation pool is summarized below:

Base Case	95 percent
No Augmentation	95 percent
1427i	88 percent
1427r	94 percent

While the No Augmentation and 1427r scenarios are similar to the Base Case, the 1427i scenario would meet the conservation pool less often.

7.2.3.2.2 South Fork Boise River

The target flows of 300 cfs and 600 cfs would not be fully met under any scenario. Table 7-8 summarizes the percent of time that the targets would be met under the scenarios. The 300 cfs winter fishery flow would be met slightly more often under the No Augmentation and 1427r scenarios than under the Base Case and slightly less often under the 1427i scenario. The 600 cfs summer fishery flow would be met similarly under all scenarios.

Table 7-8 Flow of South Fork Boise River Downstream of Anderson Ranch Dam

Flow	Percent of Time Flow is Met			
	Base Case	No Augmentation	1427i	1427r
September-March: 300 cfs	94	96	92	96
April-August: 600 cfs	91	91	91	90

7.2.3.2.3 Arrowrock Reservoir

Table 7-9 shows that the conservation pool of 28,700 acre-feet would not consistently be maintained under any scenario. The No Augmentation scenario would maintain the pool similarly to the Base Case; the 1427r scenario maintains it at a higher rate and the 1427i at a much reduced rate.

Table 7-9 Conservation Pool for Arrowrock Reservoir

Pool	Percent of Time Pool is Maintained			
	Base Case	No Augmentation	1427i	1427r
All months	67	69	51	73
August-January	42	45	24	54

7.2.3.2.4 Lucky Peak Lake

The unofficial conservation pool for Lucky Peak Lake is 28,767 acre-feet (Reclamation, 1997c). The 1427r scenarios would meet this target 100 percent of the time, while the 1427i scenario would meet the target 96 percent of the time.

The 1427r and No Augmentation scenarios would meet the unofficial target of 28,767 acre-feet 100 percent of the time; the Base Case which would meet the target slightly less often and the 1427i scenario would meet the target 96 percent of the time.

7.2.3.2.5 Boise River– Lucky Peak Dam to Glenwood Bridge

Table 7-10 lists the minimum and preferred streamflows, which range from 510 cfs to 2,950 cfs, and shows that only the minimum flow for November would be met 100 percent of the time under all scenarios; other flows would be fractionally met under all scenarios. In general, the No Augmentation and 1427r scenarios would provide the minimum and preferred flows about as often as the Base Case, while the 1427i scenario would provide the flows generally left often.

Table 7-10 Flows of Boise River Downstream of Lucky Peak Dam				
Flows	Percent of Time Flow is Met			
	Base Case	No Augmentation	1427i	1427r
October				
Minimum: 680 cfs	89	90	84	89
Preferred: 970 cfs	45	42	44	45
November				
Minimum: 510 cfs	100	100	100	100
Preferred: 1,150 cfs	2	2	0	2
December				
Minimum: 540 cfs	13	13	13	16
Preferred: 1,110 cfs	23	6	5	8
January				
Minimum: 660 cfs	31	31	18	31
Preferred: 1,240 cfs	18	18	15	18
February				
Minimum: 925 cfs	37	37	34	40
Preferred: 1,300 cfs	34	34	32	39
March				
Minimum: 1,390 cfs	50	50	44	55
Preferred: 2,950 cfs	35	37	29	57

7.2.3.2.6 Boise River at Glenwood Bridge

The minimum and preferred flows for the Boise River from the Glenwood Bridge to Star were identified and are the same as for the reach above. Table 7-11 lists the flows and shows that some flows would never be met under all scenarios and other flows would only fractionally be met by any scenario. The No Augmentation and 1427r scenarios would meet the minimum and preferred flows about as often as the Base Case, while the 1427i would generally provide those flows less often.

Table 7-11 Flow of Boise River At Glenwood Bridge				
Flows	Percent of Time Flow is Met			
	Base Case	No Augmentation	1427i	1427r
October				
Minimum: 680 cfs	0	0	0	0
Preferred: 970 cfs	0	0	0	0
November				
Minimum: 510 cfs	0	0	0	2
Preferred: 1,150 cfs	0	0	0	0
December				
Minimum: 540 cfs	15	15	11	18
Preferred: 1,110 cfs	6	6	6	8
January				
Minimum: 660 cfs	31	31	18	31
Preferred: 1,240 cfs	18	18	15	18
February				
Minimum: 925 cfs	37	37	34	40
Preferred: 1,300 cfs	34	34	32	39
March				
Minimum: 1,390 cfs	50	50	44	55
Preferred: 2,950 cfs	32	37	24	31

7.2.4 Payette River Basin

7.2.4.1 Affected Environment--Base Case Scenario

7.2.4.1.1 Cascade Reservoir

Cascade Reservoir is the second most heavily fished water in Idaho. Yellow perch have been the most abundant game fish present with rainbow trout, coho salmon, smallmouth bass, channel catfish, and black crappie making up the rest of the reservoir fishery. However, perch numbers have declined drastically in recent years. A multi-year analysis was initiated in 1998 to determine the cause and the possible role that reservoir operations may have in this decline.

Water quality is a primary concern at Cascade Reservoir. The reservoir is shallow and the direct link between water of sufficient quality to support a healthy fishery and the role of that fishery as a major prey base for resident bald eagles is of particular importance (IDFG, 1992). Bacterial contamination, algal blooms, and winter and summer fish kills have occurred in the reservoir.

In 1985, Reclamation administratively set aside 250,000 acre-feet of uncontracted storage space and 50,000 acre-feet of inactive storage space as a year-round conservation pool of 300,000 acre-feet to protect the reservoir fishery and other recreational uses. Additionally, 69,600 acre-feet have been assigned to flow augmentation. In recent years irrigation carry-over storage and Reclamation's

administrative storage designation have resulted in a minimum winter content of about 400,000 acre-feet. Even with this content, water-quality conditions have apparently deteriorated. This suggests that a 300,000-acre-foot conservation pool may no longer be sufficient to protect the reservoir fishery from the risk of a winter fish kill. IDFG now recommends that a conservation pool of 425,000 acre-feet be maintained from October through March and that there be no reservoir drawdown between April 15 and May 15 to prevent yellow perch eggs from being exposed along shoreline areas.

7.2.4.1.2 North Fork Payette River From Cascade Dam Downstream to Smiths Ferry

A high quality fishery which produces large, wild rainbow trout is located between the Cabarton Bridge and Smiths Ferry. This section of the North Fork provides good rearing and adult holding habitat for wild rainbow trout. It provides good cover and has a low gradient with a few long pools and sandy/gravel substrate. Other fish species present include coho salmon, yellow perch, brown trout, whitefish, and bullhead.

Reclamation is required to release reservoir inflow up to 200 cfs year round to satisfy hydropower water rights owned by IPC. The IDWR has approved instream flows of 400 cfs from October through February on the North Fork between Cabarton Bridge and Smiths Ferry. The minimum streamflow is 600 cfs from March through June for the same reach. These minimum streamflows are for fish spawning and egg incubation.

A minimum flow requirement of 1,400 cfs, subject to existing water rights, was established in 1992 for this reach from July through September to maintain flows for recreational purposes and fish habitat maintenance (Condition #6, IDFG Water Right Application License #65-12822).

7.2.4.1.3 Deadwood Reservoir

Deadwood Reservoir supports a popular kokanee fishery. Cutthroat trout support a secondary fishery, and landlocked Atlantic salmon were introduced in 1990. Other fish species present include rainbow trout, bull trout, rainbow/cutthroat hybrid trout, and mountain whitefish. Logging activities and natural erosion have caused extensive sediment deposition in nearby tributary streams, thus degrading some spawning and rearing habitat.

An interim conservation pool of 50,000 acre-feet at Deadwood Reservoir was administratively established by Reclamation in 1985 to protect resident fish and wildlife pending development of a more comprehensive study to determine an adequate minimum pool.

7.2.4.1.4 Deadwood River

The Deadwood River downstream of Deadwood Dam supports cold-water fish populations of rainbow trout, bull trout, and mountain whitefish. Spawning conditions for rainbow trout are excellent and rearing conditions are good, but food production is poor (IDFG, 1992). Tributaries contribute a significant portion of the sediments in the river and nutrient fertility is relatively low due to the infertile soils within the basin (Wolfin and Ray, 1984). Reclamation has reserved 30,000 acre-feet of uncontracted storage in Deadwood Reservoir to provide a winter release of 50 cfs to the Deadwood River. A year-round minimum instream flow of 125 cfs was identified for maintenance of trout rearing and spawning habitat (Pruitt and Nadeau, 1978).

7.2.4.1.5 Middle Fork Payette River to Main Stem Payette River

The reach from where the Middle Fork Payette River flows into the South Fork Payette River and continues to the Main Payette River (North Fork) supports a quality fishery for trout and mountain whitefish. Minimum flows of 407 cfs (September) and 1350 cfs (May-August) were identified for the Middle Fork to increase aquatic insect production, decrease egg mortality, and increase fish spawning and rearing habitat.

7.2.4.1.6 Payette River Main Stem From Black Canyon Dam to Snake River

Mountain whitefish are the most abundant game fish in this section of the Payette River. Other fish species include smallmouth bass, largemouth bass, channel catfish, black crappie, bluegill, pumpkinseed, yellow perch, rainbow trout, and brown trout. The Payette River does not support cold-water aquatic species or provide for salmonid spawning below the dam.

Flows downstream of Black Canyon Dam are usually low during the irrigation season due to large irrigation diversions. Significant streamflow fluctuation has contributed to the degradation of fish habitat in this reach with sand and silt deposits and poor water quality. Minimum flows varying from 1,165 cfs to 3,500 cfs were identified by the SR3 fishery TWG for maintenance of trout, bass, catfish, and mountain whitefish habitat in this reach.

7.2.4.2 Environmental Consequences

7.2.4.2.1 Cascade Reservoir

The percent of the time that each scenario would maintain the 425,000-acre-foot conservation pool from October through March is summarized below:

Base Case	66 percent
No Augmentation	78 percent
1427i	25 percent
1427r	52 percent

Under the No Augmentation scenario, the recommended conservation pool would be maintained more often than under the Base Case; while the 1427r scenario would maintain the pool slightly less often and the 1427i would maintain the pool much less often.

7.2.4.2.2 North Fork Payette River From Cascade Dam to Smiths Ferry

The minimum flows of 400-1,400 cfs for this reach would not be met 100 percent of the time under any scenario as shown in table 7-12. The No Augmentation and 1427r scenarios would be similar to the Base Case with the No Augmentation maintain flows slightly more often, and the 1427r scenario maintaining flows slightly more often in the spring months. The 1427i scenario would differ only slightly from the Base Case.

Table 7-12 Minimum Flows of North Fork Payette River Between Cascade Dam and Smiths Ferry				
Flows	Percent of Time Flow is Met			
	Base Case	No Augmentation	1427i	1427r
October - February: 400 cfs	24	29	22	26
March - June: 600 cfs	57	60	56	65
July - September: 1,400 cfs	36	17	42	34

7.2.4.2.3 Deadwood Reservoir

The administrative conservation pool of 50,000 acre-feet would be maintained at all times under all scenarios with possibly one exception. Under extreme drought conditions the conservation pool might not be maintained under the 1427r scenario.

7.2.4.2.4 Deadwood River

All of the scenarios would meet this minimum flow recommendation of 125 cfs less than 50 percent of the time as shown below:

Base Case	47 percent
No Augmentation	48 percent
1427i	45 percent
1427r	46 percent

All scenarios would vary slightly from the Base Case; the No Augmentation scenario would meet the minimum flows most often and the 1427i scenario would meet the flow least often.

7.2.4.2.5 Middle Fork Payette River to Main Stem Payette River

Table 7-13 lists recommended minimum flows and the success of the scenarios in meeting those flows. The fall through spring recommended flow (407 cfs) would be met similarly under all scenarios, including the Base Case. The summer flow (1,350 cfs) would generally be met more often under the 1427i and 1427r scenarios than under the Base Case and No Augmentation scenarios.

Table 7-13 Minimum Flows for the Middle Fork to Main Stem Payette River				
Flow	Percent of Time Flow is Met For the Entire Period			
	Base Case	No Augmentation	1427i	1427r
September - April: 407 cfs	98	98	99	99
May - August: 1,350 cfs	74	73	83	78

During May and June, the 1,350-cfs minimum flow would be met 97 to 98 percent of the time by all of the scenarios.

7.2.4.2.6 Payette River From Black Canyon Dam to Snake River

None of the scenarios would meet the recommended flows more than 65 percent of the time as shown in table 7-14. All scenarios would meet the winter minimum flows (1,165 cfs) slightly more often and the summer minimum flows (1,800 cfs) much more often than the Base Case. Spring minimum flows (3,500 cfs) would be met about the same by all scenarios. The 1427r scenario would meet all minimum flow recommendations more often than the Base Case or other scenarios.

Table 7-14 Minimum Flows of the Payette River From Black Canyon Dam to Snake River

Flows	Percent of Time Flow is Met			
	Base Case	No Augmentation	1427i	1427r
October - February: 1,165 cfs	48	51	54	56
March - May: 3,500 cfs	65	62	61	65
June - September: 1,800 cfs	26	41	60	64

7.2.5 Owyhee River Basin

7.2.5.1 Affected Environment--Base Case Scenario

7.2.5.1.1 Lake Owyhee

Introduction of largemouth bass, crappie, and yellow perch began soon after reservoir impoundment in the 1930s. Channel catfish and smallmouth bass have persisted in the reservoir after being stocked in the 1960s and 1970s. Black crappie are the most common game fish found in Lake Owyhee and most prevalent from the dam upstream to Leslie Gulch. Crappie typically spawn between Dry Creek and Three Fingers Gulch in shallow bays with a gravel or rock bottom.

Largemouth bass inhabit areas of submerged broken rocks and other locations, with spawning areas located on shallow gravel points between Dry Creek and Leslie Gulch. Smallmouth bass prefer similar habitat to largemouth bass.

Channel catfish occur throughout the reservoir largely due to stocking efforts. Yellow perch and brown bullhead occur throughout the reservoir as well. Rainbow trout are likely from redband stock from the Owyhee River and tributary streams such as Dry Creek. Although few in number, trout inhabit most areas of the reservoir. There are several nongame fish species, including northern squawfish, carp, largescale suckers, bridgelip suckers, chiselmouth, speckled dace, redside shiners, and others.

Populations of bass and crappie have decreased in recent years. Some analysis has been done to determine factors which contribute to the decline. Fluctuating reservoir levels, particularly in June during spawning, can impact fish production. Drops in water level can force fish off nests, or expose nests to predation or dessication. Changes in water temperature can also affect spawning. In addition, bass tournaments held during the spawning season reduce fish propagation. (Reclamation, 1994a)

7.2.5.1.2 Owyhee River Downstream of Owyhee Dam

The Oregon Department of Fish and Wildlife (ODFW) manages the lower 16 miles of the Owyhee River from Owyhee Dam to the Owyhee ditch diversion as a trout fishery (Reclamation, 1994a). Cold-water releases from Lake Owyhee provide suitable temperatures for trout development and rearing. This section of the Owyhee River is popular with anglers as the ODFW stocks the river annually with 20,000-40,000 fingerling rainbow trout which provide a quality trout fishery. A catch-and-release fishery exists for brown trout where trophy-sized brown trout are frequently sought by anglers.

The major limiting factor to trout production downstream of Owyhee Dam is low streamflow during the nonirrigation season (mid-October to mid-April) when reservoir releases are discontinued to store water for the next irrigation season (Reclamation, 1994a). Any flow downstream of Owyhee Dam during the nonirrigation season comes from seepage and natural springs and amounts to about 8 to 10 cfs. The ideal winter minimum flow for the lower Owyhee River is estimated between 50-75 cfs (Reclamation, 1994a); however, ODFW has indicated that an Instream Flow Incremental Methodology analysis is needed to verify the most appropriate flow. The river below the Owyhee ditch is managed for warm-water fish since water temperatures are not favorable for trout.

7.2.5.2 Environmental Consequences

7.2.5.2.1 Lake Owyhee

Although precise data are not available, a reasonable effects analysis may be made by reviewing figures 5-22 and 5-23. In general, the No Augmentation and 1427r scenarios would be similar in effect on reservoir elevations to the Base Case; whereas the 1427i scenario would result in overall lower elevations.

7.2.5.2.2 Owyhee River Downstream of Owyhee Dam

Again, although precise data may not be available, a reasonable effects analysis may be made by reviewing figure 5-22 and table 5-13. Flow releases from Owyhee Dam would be similar for the Base Case and No Augmentation scenarios while there would be significantly increased flows during the spring and late summer months under the 1427r and 1427i scenarios. Minimum flows (10cfs) during the October-March period would be met less often with the 1427r and 1427i scenarios than with the Base Case and No Augmentation scenarios. Minimum flows (100cfs) during the April-September period would be met more frequently under 1427r and 1427i scenarios than under either the Base Case or No Augmentation scenario.

7.2.6 Snake River Main Stem Downstream of Hells Canyon Dam, Salmon River Basin, and Grande Ronde River Basin

7.2.6.1 Affected Environment–Base Case Scenario

7.2.6.1.1 Snake River Main Stem From Hells Canyon Dam to Lower Granite Lake

Spring, summer, and fall chinook salmon; steelhead; sockeye salmon; Pacific lamprey; smallmouth bass; crappie; trout; white sturgeon; redband trout; bull trout; channel catfish; and bullheads are found in this river reach. This reach is a migration corridor for adult and juvenile anadromous fish which have greatly declined in numbers (see Threatened and Endangered Species).

Resident game species caught by anglers include smallmouth bass, crappie, and rainbow trout which are stocked annually. White sturgeon also inhabit this basin; however, harvest is no longer permitted below Hells Canyon Dam due to depressed populations. Redband trout are the native trout species between Brownlee and Hells Canyon Dams. Bull trout have been documented in several tributaries of the Snake River within this reach and some evidence exists that bull trout may use the reservoirs when temperature conditions are favorable (IPC, 1971).

Operational practices of hydroelectric facilities, destruction of habitat, reduced food production, over harvest, disease, and predation have had adverse effects on the fish species in this reach. Daily and weekly water fluctuations cause shoreline erosion and turbidity, reducing food production and availability. All of these factors have contributed to the decline of fish numbers in this reach.

7.2.6.1.2 Salmon River Basin

The lower Salmon River basin includes spring and summer chinook, steelhead, sockeye, redband trout, cutthroat trout, bull trout, smallmouth bass, sturgeon, white sturgeon, and whitefish. It is a migration corridor and wintering area for adult and juvenile anadromous fish (see Threatened and Endangered Species section). Fishing opportunities exist for cutthroat trout and smallmouth bass. Sturgeon and bull trout are present in this reach.

Resident cutthroat trout, bull trout, and mountain whitefish are located in the South Fork. Bull trout, which now have statewide harvest closures, have declined due to over harvest, competition, and land management activities.

The North Fork supports a small number of white sturgeon as well as steelhead spawning and rearing. Native resident trout include redband, bull, and cutthroat. Trout densities at some locations have declined consistently.

Most of the Middle Fork Salmon River lies in a pristine wilderness area with good to excellent habitat quality; but, some important spawning and rearing habitat lies outside the wilderness area and has been degraded by mining, grazing, and logging. The Middle Fork has predominantly a native resident game fishery which includes bull trout, cutthroat trout, and whitefish.

Factors which affect the fishery include siltation; ranching and grazing practices; unscreened irrigation diversions; water quality; low flows and dewatering; channel alterations; and migration limitations associated with dams on the Salmon River (removed in 1934), lower Snake River, and Columbia River.

7.2.6.1.3 Grande Ronde River Basin

The Grande Ronde River basin includes spring chinook salmon, fall chinook salmon, summer steelhead, bull trout, Pacific lamprey, redband trout, whitefish, and smallmouth bass (see Threatened and Endangered Species section). Redband trout are widely distributed throughout the basin and inhabit many diverse types of habitat. Hatchery supplementation programs of rainbow trout have affected many of the native redband populations through inbreeding and habitat competition. Small populations of bull trout are present in headwater portions of tributaries and in portions of the lower basin. Bull trout and brook trout co-exist, interbreed, and produce sterile hybrid offspring. The Pacific lamprey populations have become severely depressed and may be absent (under consideration as a candidate for threatened or endangered status).

Factors which affect these species include quality of the riparian habitat, consistent streamflows, abundance and diversity of riparian vegetation, and stable water temperature.

7.2.6.2 Environmental Consequences

A quantitative analysis of flows in these stream reaches was not made for this analysis. However, any increase in flows in the main stem Snake River would be beneficial. Removing irrigation lands from production in the Salmon and Grande Ronde River basins (1427i and 1427r scenarios) would increase streamflows during the irrigation season as there are no storage facilities to regulate streamflow in these basins. Any increase of flows in these streams would be beneficial to fish and other aquatic organisms.

7.2.7 Summary

On an overall ranking for the river and reservoir system upstream of Brownlee Dam, the No augmentation scenario would be better than or similar to the Base Case, the 1427r scenario would be about equal to the Base Case. The 1427i scenario would be worse than the Base Case for fish maintenance and production in reservoirs. Flow augmentation under the 1427r and 1427i scenarios would not necessarily improve (i.e., not necessarily meet flow recommendations more often) habitat conditions for resident fisheries in most river reaches. However, this overall ranking and summary does not hold true for specific river reaches and reservoirs.

It is important to recognize that rivers and reservoirs within the area of analysis are operated to meet contractual obligations and water rights. Environmental considerations including flows for fish are typically secondary to meeting other obligations. In response, fish and wildlife agencies now managed some river reaches for warm water species and non-native species that have replaced cold water and native species in some river reaches. Fish are managed in declining environmental conditions and any further deterioration of conditions can only add more stress to biotic systems.

Fishery interests continue to ask for operations that would optimize fish resources, while recognizing that irrigation demands control reservoir releases and diversion of water. Reclamation continues to seek to balance desires to maintain and improve fish resources as it honors the contract obligations.

7.3 Wildlife and Vegetation, Including Wetlands and Riparian Habitat

There are many wildlife and plant species of concern within the Snake River basin which would be affected by the flow augmentation scenarios. Potential effects of the scenarios on fish in general are discussed in the Fish section, while effects on plants and animals that are listed under the ESA are discussed in the Threatened and Endangered Species section. This section discusses general categories of wildlife and plants and their habitats that may be affected by flow augmentation scenarios.

Wildlife rely heavily on riparian zones for food, water, cover, and travel corridors in the arid West. Riparian zones also provide important vegetation types not found elsewhere. Changes in river and reservoir system operations that reduce wetlands, open islands to predation, and reduce forage habitat would generally have a negative impact on wildlife and/or vegetation. River system operations which ameliorate or eliminate these conditions would have a positive impact. The key is understanding when these conditions occur relative to river system operations. There has been very little empirical research done to identify how wildlife and vegetation are affected by river system conditions and operational changes.

The SR^3 wildlife and vegetation TWG worked to uncover existing research on riverflows and reservoir elevations critical to wildlife and vegetation in the Snake River basin. Due to the absence of such

information, the TWG explored other methods for identifying potential effects of riverflows and reservoir elevations on wildlife and vegetation. Those methods are still under development and evaluation and not available for use in this analysis of potential effects. Therefore, Reclamation could not develop a defensible analysis which adequately represents potential impacts of the flow augmentation scenarios to the general class of plants and animals.

Therefore, in this report, Reclamation has limited its evaluation to a subjective analysis of potential impacts of the flow augmentation scenarios to the general class of plants, animals, and their affected habitats. If the flow augmentation scenarios are considered in the future, it would be necessary to conduct a detailed, site-specific analysis of potential impacts related to all plant and animal species and their respective habitats.

Many Native Americans continue traditional practices of harvesting wildlife and vegetation for all or portions of their sustenance. Changes in access to, or abundance of wildlife and vegetation could affect Native American opportunities to hunt and gather these resources.

7.3.1 Affected Environment

7.3.1.1 Snake River Main Stem Upstream of Brownlee Dam

Many species of wildlife are found in the Snake River basin. Only those species that may potentially be affected by flow augmentation are addressed in this discussion. Most wildlife depends in one way or another on riparian or wetland vegetation communities. River and reservoir operations that affect these habitat types may also affect wildlife. Vertebrates that either reproduce or feed in water may be totally dependent on riparian zones for their survival and would be most affected by flow augmentation. Species that depend upon riparian and wetland vegetation for nesting habitat, escape cover, feeding zones, or travel corridors would also be affected.

Another habitat component addressed in this section is agricultural lands. Many of the same species of wildlife that rely on riparian corridors to fulfill life requirements also frequent or inhabit adjacent agricultural lands. Plant communities on agricultural lands provide seasonal food and cover for upland wildlife as well.

7.3.1.1 Wetlands and Riparian Zone Vegetation, Including Cottonwood Forests

Wetlands in the Snake River basin are located along the major streams and rivers. Additional wetlands are found along smaller tributaries, at seeps and springs, at higher elevation wet meadows, and along the shorelines of natural lakes. Most of the wetlands in the study area are either palustrine herbaceous (emergent marsh, aquatic bed), or palustrine woody (shrubs and trees) wetlands consisting of wet meadows, seeps, small shallow ponds and lakes, marshes, and riparian wetlands along streams. More specifically, there are several primary vegetative associations within the general category of wetlands along the river systems and on lands within the basin:

(1) Remnant “gallery” or floodplain forest with large cottonwoods and tree-form brittle willows in the overstory and a very diverse understory of willow, alder, and annual and perennial herbaceous vegetation–Presentative sites in the basin are found on the South Fork Snake River downstream of Palisades Dam, the Fort Hall Bottoms, the McTucker Island area of American Falls Reservoir, the Thousand Springs area, and on the Snake River near the confluence of the Boise River. Upper reaches of the Snake River, Henrys Fork, Boise River, and Salmon River also contain remnant

cottonwood forests. Regeneration of these floodplain forests is dependent on periodic, large scale disturbance through flooding. Absence of such flood events is adversely affecting regeneration of these remnant forests, especially on the Snake River.

(2) Riparian association of woody and herbaceous species along small streams, seeps, and runoff channels, and at the outer periphery of reservoirs, lakes and ponds–These generally are dense growths of willow, hawthorn, and/or alder in association with wet meadow grasses, sedges, and stands of emergents such as cattail and bulrush.

(3) Emergent wetlands associated with reservoir drawdown zones–These types are not necessarily associated with active streamflows or bank seepage. The thousands of acres of mudflats exposed during seasonal drawdowns constitute an ephemeral wet meadow community extremely important as feeding areas for migrating shorebirds and waterfowl. For example, as the water level recedes in American Falls Reservoir, upper portions of the mudflats are colonized each year by cockleburs, goosegrass, beggar's ticks, and knotweed. Where inundation is longer and water withdrawal slower, Mediterranean annual grass is the dominant species; associates are blunt-leaved yellow-cress and marsh cutweed. The Alpine Meadows area at the upper end of Palisades Reservoir is managed to encourage wetland vegetation and associated wildlife.

(4) Riparian association along high or steep riverbanks–There is little floodplain development for hundreds of miles where the Snake River and other streams flow through narrow valleys or deep gorges. In these reaches, riverine riparian woody species are restricted to a few species such as Russian olive, black and common cottonwood, and water birch with an understory of squawbush, currant, and Wood's rose. Islands and promontory backwaters along the Snake River maintain small scattered stands of rushes, cattails, sedges, and common reed.

(5) Wetlands associated with agricultural practices–Wetlands created as a result of agricultural practices may include farm ponds, wet pastures, drainage channels, tailwater accumulation sites, and groundwater seeps. Vegetation vigor and types vary at these sites depending on the reliability and amount of water available for wetland sustenance. Associations may range from grass/sedge pastures and cattail/bulrush fringed ponds to willow-choked draws.

In the semiarid lowland, wetlands are critical to many species of wildlife because they provide diverse habitats with good vegetative growth for food and cover, water, and invertebrate production. A wide variety of wildlife inhabit these wetlands, including waterfowl, shore and wading birds, furbearers, reptiles and amphibians, song birds, and other aquatic and semiaquatic species. Native and introduced fish species also thrive in the wetlands which provide backwater areas for spawning, feeding, and rearing of young.

Based on information provided in the 1991 Cascade Reservoir Resource Management Plan (Reclamation, 1991) wetlands extend along all but a short section of the west shoreline of the reservoir near Tamarack Falls Bridge. They provide important cover and feeding areas for wading birds and ducks.

Portions of American Falls Reservoir, particularly the Fort Hall Bottoms and the McTucker Island area, represent remnant floodplain forests, with large cottonwood, willows and herbaceous vegetation (Reclamation, 1994b). The Alpine Meadows area at the upper end of Palisades reservoirs is managed to encourage wetland vegetation and associated wildlife.

The existence and maintenance of cottonwood forests and other riparian vegetation is dependent upon the size and timing of episodic flood events with seasonal timing of flow being critical. Large floods create the bare substrate needed for seeds to germinate. For greatest benefit, the flood event should occur prior

to seed dispersal in late June and early July. Falling river stages should occur during seed dispersal so that bare substrates are moist. Besides the seasonal timing, the spacing in years between events can affect colonization. Large floods can remove very young seedlings. A longer time between floods should allow seedlings to withstand larger floods. After the flood event, declining stages must be gradual enough to insure seedling survival.

Operations which serve to sustain riparian vegetation would also meet associated needs of raptors, colonial nesting birds, and neotropical passerine birds. Actions which modify naturally fluctuating water regimes, eliminate or reduce channel and shoreline diversity, diminish vertical or horizontal vegetative structural complexity, or fragment and isolate riparian communities tend to lower habitat quality for species that are restricted to or are seasonally dependent on riparian habitats.

Many of the wetlands, both natural and created, have been modified, degraded, or destroyed over the last 100 years by land use practices and manipulation of water sources. The elimination and degradation of riparian ecosystems and wetlands, and the corresponding losses of wildlife habitats, can be attributed to: channel alteration, groundwater pumping, surface water diversion, impoundment, direct removal of riparian vegetation, alteration of flooding regimes, and urbanization. Contaminants, recreation, livestock grazing, and habitat fragmentation also contribute to the degradation of viable habitat for wildlife in riparian systems. Efforts have been made in the basin to protect and manage some natural and created wetland sites through incorporation into the National wildlife refuge system and into state wildlife management area programs.

In addition to fish and wildlife values, wetlands and woody riparian zones are important gathering areas for Native Americans. Wetlands may contain willows, reeds, grasses, and cottonwoods which are used in traditional practices or ceremonies. Aquatic furbearers, found in wetland environments are also a part of some traditional Native American uses.

7.3.1.1.2 River and Reservoir Shoreline Wetlands

Wetlands require inundation or saturation by surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands along the river corridor are adversely affected by continuous low flow conditions which result in little or no overbank flooding and an absence of water supply to backwater slough areas. Wetland acreage is reduced along reservoirs where low reservoir water levels expose and dry shallow overbank substrates, leaving only deep water habitats. These conditions can be especially detrimental to wetlands during the growing season. The effects on aquatic macrophytes addressed below would also apply to wetlands since habitats that do not support hydrophytic vegetation are not considered wetlands even though the hydrology may be present.

7.3.1.1.3 Aquatic Macrophytes

The seasonal timing of a flood is of great importance to the survival of woody hydrophytic vegetation. Dormant seasonal flooding usually has no effect on woody plants and may even have a beneficial effect by increasing water available in the soil through the summer. Conversely, seedlings flooded after leaf flush are very susceptible to damage. Flood duration and depth during the growing season can affect survival of woody hydrophytes. In reservoirs, colonization of shorelines by woody plants is unlikely if flood duration exceeds 40 percent of the growing season. Evidence suggests some woody species that provide wildlife benefits could thrive in reservoir drawdown zones. The depth of flooding during the growing season can influence the degree of injury or survival of woody plants especially if completely inundated. Even woody species adapted to survive in wet or saturated soil conditions cannot survive complete submersion for more than 20 days.

The major factors affecting the establishment of floating and emergent aquatic vegetation are water depth, current fluctuation, wave action, temperature, transparency, substrate, and water chemistry. Waterfowl herbivory can also be a factor in the establishment of floating and emergent vegetation. Water level fluctuations can be managed on controlled reservoirs to encourage the growth of desirable aquatic macrophytes. Water management schedules that correspond to the natural life cycles would encourage the growth of desirable aquatic plants that provide food and cover for waterfowl and other species of wetland wildlife.

7.3.1.1.4 Riverine Islands

The most important island forming events are larger floods. During these larger events, gravel, cobble, and other materials are moved around and deposited to form islands. Smaller floods yield small islands. A study has shown that islands formed downstream from Palisades Dam after gate closure are smaller than those formed under the natural-flow regime, are less elevated, and may have formed more gradually.

The preliminary results of studies conducted on islands located within the Deer Flat National Wildlife Refuge (Lake Lowell) indicate that as flow volume increases, the number of islands that are adequately protected from predators also increases. Island isolation is measured as a function of water velocity and the distance a predator would have to swim and wade to cross the river to an island (IDFG, 1992).

7.3.1.1.5 Agricultural Lands

Current agricultural practices and cropping patterns are discussed in Chapter 6, Economic Analyses. The type of vegetation associated with agricultural lands along the Snake River Plain is dependent on whether the lands are irrigated or not. Irrigated lands may be planted in row crops, grains, orchards, hay, or pasture grasses. Dry lands are mostly grains or seeded grasslands. Other plant and habitat associations found in association with agriculture include windbreaks, weedy edges, fence rows, and farm ponds. Upland species such as song birds, pheasants, and quail depend on agriculture lands for food, nesting, and cover. Small rodents are generally attracted to farm grounds and adjacent lands. Raptors, waterfowl, and other water-oriented species visit agricultural areas to find prey and food.

7.3.1.1.6 Wildlife

7.3.1.1.6.1 Raptors

Two of the most important raptors in the area are the bald eagle and the peregrine falcon which are listed under the ESA and discussed in the Threatened and Endangered Species section. However, a wide variety of hawks, owls, and other raptors are found in the area. Most of these are dependent in some way on water courses and associated riparian vegetation for cover, food sources, and bathing. Various birds of prey, including ospreys, red-tailed hawks, Swainson's hawks, burrowing owls, and barn owls, nest along the Snake River. Many of these birds rely on abundant prey sources on adjacent native shrub-steppe uplands and on adjacent agricultural lands.

7.3.1.1.6.2 Waterfowl, Shorebirds, and Other Birds

Ducks are one of the most plentiful waterfowl in the area. The Snake River remains free of ice most winters and affords habitat for many species of waterfowl like common goldeneye. During the breeding and nesting season, increases in reservoir water levels and/or riverflows can flood nests established along the shorelines of riverine islands. This relationship is especially critical when water levels rise rapidly after the initiation of nesting activities, usually after May 1. Higher water levels can, however, be

beneficial after the waterfowl broods hatch. Water levels that flood adjacent aquatic or terrestrial vegetation provide escape cover and foraging habitat. Operations which develop and support wetland habitats (up to 18 inches in depth) provide needed aquatic invertebrate food sources and support aquatic macrophytes which also provide important forage. Lower riverflows can form land bridges to nesting islands making nests susceptible to predation and human disturbance. Water levels should fluctuate during the winter period and prevent ice formation. The amount and distribution of open water, along with the availability of waste grains, are factors that determine duck usage during the winter.

Canada geese, like ducks, use islands in the Snake River for nesting purposes. The nests are subject to flooding from rapidly rising waters and are subject to nest predation and human disturbance when flows drop low enough to form land bridges. Geese benefit from fluctuating water levels in the winter as ice does not form on the river and reservoirs. On the Snake River downstream of Palisades Dam, flows between 8,000 and 16,000 cfs were found to increase Canada goose nesting success.

Aquatic macrophytes of the Henrys Fork can no longer provide enough winter food to support the increasing flocks of trumpeter swans, Canada geese, and ducks. Present management efforts are directed toward reducing the wintering population of trumpeter swans on the Henrys Fork and include increasing flows from Island Park Dam in early October to reduce foraging opportunities and force the swans to migrate out of the area before the onset of winter (IDFG and USFWS, 1994).

Flows have to be precisely managed; if too low in the fall and winter, optimum feeding conditions exist encouraging trumpeter swans to remain in the area. This results in the depletion of existing aquatic vegetation during the winter. Low flows late in the winter allow the stream to freeze and inhibit feeding activities resulting in increased winter mortality of swans.

Operation of the reservoirs on the Snake River has a significant impact on shorebirds that migrate through the corridor. If mud flats are inundated during the spring/fall migration season or exposed too early before migration, detrimental impacts on shorebird populations could occur. Shorebird abundance is anchored in seven key species, although there are 25 or more who regularly frequent American Falls Reservoir. These seven are the lesser yellowlegs, the killdeer, western sandpiper, Baird's sandpiper, long-billed dowitcher, Wilson's phalarope, and the avocet. Over 2,000 Franklin's gulls and up to 35,000 white-faced ibis use the reservoir mud flats as a migration staging area. Avocets breed at American Falls Reservoir, along with white-faced ibis, snowy and great egrets, black-necked stilts, snowy plovers, and California and ring-billed gulls.

Migratory shorebirds need staging areas to refuel and complete their migration. Several large reservoirs on the Snake River, particularly American Falls, fulfill this need. American Falls Reservoir is a "Waterfowl Habitat Area of Special Concern" in the North American Waterfowl Management Plan (Reclamation, 1994b). Many shorebirds remain in the area through the spring. The principal operational impact that affects shorebirds is the exposure of mudflat foraging habitats as the reservoirs are drawn down in the summer and fall. Food sources for the spring migration (peaks from mid-April to mid-May) require fall flooding approximately 1 month before the first heavy freeze and the continued maintenance of flooded conditions to enable invertebrates to lay eggs and to assure survival of larvae over winter. Rapid growth of annual grasses, followed by inundation and decay, are ideal conditions for building the base food chain and an array of species diversity. The deep, soft mud harbors midge larvae and worms. Shorebirds migrating from the Arctic to South America use the site by the tens of thousands. During the spring migration season, reservoirs drawn down slowly (1-1.5 inches per week) make invertebrates continuously available to shorebirds foraging on mudflats.

Fall migration (peaking from mid-July to mid-September) is considered to be the most important for shorebirds on the Snake River. Production of food supply for the fall migration requires similar

conditions as for the spring migration; however, the timing is different. The mudflats must remain flooded through spring and early summer and then be slowly exposed during the migration season. Mudflats that remained dry during the early spring need to be shallowly flooded 2 to 3 weeks before the fall migration begins to allow time for invertebrates to repopulate the newly created habitat. Maintaining a full reservoir level through the fall eliminates any available shorebird habitat.

Colonial nesting birds (e.g. heron, egret, cormorant, pelican) stalk prey by wading in shallow water or ambush the prey from perches located in shrubs or trees hanging over the adjacent water body. An optimum habitat for colonial nesting birds is created by reservoirs that provide adequate habitat, have operational conditions that support a healthy riparian zone (especially the cottonwood forest adjacent to the Snake River), and provide a good fishery.

Flow conditions can affect foraging ability and success. Flows that are too swift or produce turbidity can have a negative impact on foraging success. Low flows can affect the heron group (great blue herons and black-crowned night heron) if water depths are too shallow for overbank feeding habitats or if water levels are far removed from adjacent vegetation.

Sandhill cranes nest in the province. Canyons of the Snake, Owyhee, and other streams support numerous species such as white-throated swifts and canyon wrens. The Snake River bottom lands at Adrian have been the most consistent site in Oregon for yellow-billed cuckoos. Merriams Turkey is also common in the riparian zone of the lower Boise River and Snake River confluence

Islands within the Snake River support nesting colonies of great blue and black-crowned night herons and California and ring-billed gulls. Over 600 bank swallow burrows in three colonies were found during a 1991 survey of the Snake River. There are also good populations of loggerhead shrikes, a species on the decline nationwide according to breeding bird surveys, and the area is used by long-billed curlews.

Agricultural lands along the river corridor provide feeding areas for migrating and wintering waterfowl. Shore and wading birds (i.e., gulls, herons, cranes, ibis) are also attracted to agricultural lands to feed, especially during flood irrigation of pasturelands, plowing of fields, and haying.

7.3.1.1.6.3 Aquatic Furbearers

Operational conditions that maintain a healthy riparian habitat and a good fishery would provide optimum habitat for most aquatic furbearers. These include otter and beaver. The best water levels or flows for this group are high enough to flood or remain adjacent to aquatic or riparian vegetation. This condition provides easy and safe access to cover, travel corridors, denning sites, and foraging habitat.

7.3.1.1.6.4 Mammals

Riverflows and reservoir levels which maintain abundant vegetative food sources and cover would support the mammals in this area. These include elk and moose at upstream sites and deer along most riparian areas. A variety of carnivores and small mammals also rely on riparian and farmland associations for their life requirements.

7.3.1.1.6.5 Amphibians

Snake River operations that affect adjacent river and reservoir wetlands by altering groundwater levels, soil saturation, or overbank recharge of wetlands due to low flows may have detrimental impacts on many species of amphibians especially if these wetlands are affected during the spring breeding season.

Additional information is needed to better understand the relationship between operations and amphibians.

7.3.1.2 Owyhee River And Lake Owyhee

The USFWS, ODFW, and the Oregon Natural Heritage Program have identified eight special status plant species within the Owyhee River and Lake Owyhee area. Shrub-steppe communities dominate the landscape surrounding Owyhee River and Lake Owyhee. Big sagebrush communities dominate nearly every vegetation mosaic. The alkaline soils on the flats just above the upper Owyhee River support a salt desert shrub mosaic. These communities are most common where interior drainage and old lake beds are typical. Cottonwood, coyote willow, hawthorn, chokecherry, juniper, and hackberry should be considered of special importance or interest that could be affected by changes in Owyhee River flows and Lake Owyhee elevations.

Agricultural communities in the lower Owyhee River drainage area are similar to those described in section 7.3.1.1.5.

7.3.1.2.1 Riparian Vegetation

Riparian vegetation grows along the major perennial streams as well as some intermittent streams within the basin. Riparian vegetation also grows in association with seeps, springs, meadows, and in isolated locations along the perimeter of Lake Owyhee. The presence of water and alluvial soils are the primary attributes that distinguish these ecosystems from upland communities.

Dominant tree and shrub species in the riparian zone are black cottonwood, coyote willow, hawthorn, alder, and chokecherry. Oases created by humans contain riparian species and exotics like Russian olive and Lombardy popular (ODFW, 1993). In isolated areas along the Owyhee River, juniper and hackberry also occur. Numerous species of meadow grasses, sedges, rushes, and forbes occupy the riparian under story. Greasewood dominates in the alkaline riparian areas. Riparian vegetation along the upper Owyhee River is limited by the periodic high volume of water during spring runoff. As a result of high flows, flexible herbaceous plants predominate. Alder, currant, mock orange, clematis, and willow occur in pockets in the Birch Creek riparian zone down to the Owyhee River. Riparian areas along the upper river are showing vegetative recovery from historically heavy livestock use.

In 1984, Congress designated 120 miles of the main stem Owyhee River from the Oregon-Idaho border downstream to Lake Owyhee as wild (see Wild and Scenic River section). The primary emphasis for wild river areas is to protect and enhance the values which make it remarkable while providing river-related outdoor recreation opportunities in a primitive setting. Congress recognized recreation, cultural, geologic, wildlife, and scenic values on the main Owyhee River to be remarkable.

7.3.1.2.2 Wildlife

USFWS, ODFW, and the Oregon Natural Heritage Program have identified 26 special-status wildlife species within the Lake Owyhee and Owyhee River area. Mule deer, California bighorn sheep, beaver, muskrat, river otter, mink, waterfowl (mainly diving duck species), Canada geese, neotropical birds, raptors, and amphibians should be considered of special importance or interest that could be affected by changes in river flows or lake elevations on the Owyhee River or Lake Owyhee.

7.3.1.2.2.1 Mammals

Lake Owyhee and the Owyhee River traverse 124 miles of ODFW's Owyhee Big Game Management Unit. The river and reservoir contribute greatly to wildlife diversity, carrying capacity, and distribution in the adjacent uplands of the Management Unit. Many species of wildlife indigenous to the Management Unit depend on the Owyhee River and Lake Owyhee as their primary source of water. Mule deer are well distributed throughout the area. Densities are influenced by the availability of water, later summer forage, and escape cover. The habitats influenced by both the Owyhee River and Lake Owyhee provide all these requirements. The management unit contains approximately 5,000 mule deer, approximately 1.7 deer per square mile.

California bighorn sheep, a Federal candidate species for listing under the ESA, were introduced to the Owyhee drainage in 1965 after being absent for over 50 years. The 1994 bighorn population in the Lake Owyhee area was estimated at 225 with an area of use extending for 19 miles on the east bank of Lake Owyhee. Bighorn sheep can frequently be spotted from Lake Owyhee; the best viewing opportunities occur in the summer and fall.

Pronghorn antelope occur in the area but generally inhabit the sagebrush plateaus beyond the zone of influence of Lake Owyhee and are not as dependent on the reservoir as are mule deer and bighorn sheep. Other mammals which occur in the reservoir area include Nuttal's cottontail, domestic wild horse, and several species of rodents and bats. Wild horse sighting is common along the reservoir's east shoreline from Wild Horse Creek to Cherry Creek.

Deer, small mammals, and small carnivores (i.e. coyote, fox, skunk) also inhabit the farmlands and adjacent upland sites.

7.3.1.2.2.2 Furbearers

A number of regulated and unregulated furbearers (beaver, river otter, muskrat, and mink) occur within the riparian habitats or uplands surrounding Lake Owyhee and the Owyhee River. Furbearers associated with both riparian and upland habitats include raccoon, bobcat, coyote, stripped skunk, spotted skunk, long-tailed weasel, and badger.

7.3.1.2.2.3 Upland Game Birds

Common upland game birds include chukar, California quail, and mourning dove. The chukar partridge, an exotic species, was introduced to eastern Oregon in 1951. The Owyhee drainage provides some of the best chukar habitat in the western United States where introduced populations have flourished. Ring-necked pheasant, quail, and dove inhabit the farmlands in the lower Owyhee River basin.

7.3.1.2.2.4 Waterfowl

A variety of waterfowl make sporadic use of Lake Owyhee. The species most commonly found on the reservoir are migrant diving ducks and the common merganser. Diving ducks that migrate and winter on Lake Owyhee include lesser scaup, common goldeneye, bufflehead, and ringneck duck. These ducks utilize ice-free areas on the reservoir feeding mainly on aquatic insects. Common mergansers can be found on the reservoir year round feeding on the abundant populations of fish. Dabbing ducks are less common due to the lack of shallow water and utilize the reservoir mainly for resting. A few Canada geese breed at the reservoir and others are attracted to the green feed available below the high-water line following reservoir drawdown. Migrating and wintering waterfowl also feed on adjacent agricultural areas.

7.3.1.2.2.5 Raptors

Raptors such as the red-tailed hawk, northern harrier, great horned owl, and turkey vulture are common in riparian and upland habitats surrounding the reservoir and river. The numerous rock cliffs, spires, and rimrock areas provide excellent nesting habitat for golden eagles and prairie falcons. Twenty to thirty northern bald eagles use the Owyhee River and Lake Owyhee for wintering; many others migrate through the area during the fall and spring. Resident and migrating raptors also find prey on adjacent farmlands.

7.3.12.2.6 Other Birds

Common birds associated with reservoir shoreline areas and riparian habitats along the river include great blue heron, killdeer, belted kingfisher, several species of swallows, American crow, American robin, black-billed magpie, brown-headed cowbird, European starling, northern flicker, western kingbird, western meadowlark, and white-throated swift.

7.3.2.2.7 Amphibians and Reptiles

Some of the more common amphibians occurring in moist habitats influenced by the reservoir and river include Great Basin spadefoot toad, western toad, and Pacific treefrog. Excellent and abundant reptile habitat occurs in the area and supports species such as western fence lizard, whiptail, collared lizard, horned lizard, side-blotched lizard, gopher snake, racer, and western rattlesnake.

The western ground snake is found along the Owyhee River. The Snake River population of the leopard frog is of interest because of its peripheral status. Species like the longnose leopard lizard, desert horned lizard, western whiptail, desert collared lizard, Woodhouse's toad, and Great Basin spadefoot toad are common in the Owyhee River drainage.

7.3.1.3 Hells Canyon National Recreation Area

7.3.1.3.1 Riparian Areas

An important feature of the Snake River riparian zone is the dominance of hackberry which is the most common tree along the river and is a important source of browse for big game species. Its fruit is used by birds and small animals. Invasions of noxious weeds, including leafy spurge and knapweed, are encouraged by fluctuating flows which provide habitat for germination (Wallowa National Forest, 1998). The USFS has noted the following concerns for the Hells Canyon Natural Recreation Area (HCNRA):

- Effects caused by construction of impoundments and the change from a free-flowing riverine habitat to a large, slack-water impoundment.

- Habitat fragmentation caused by construction and operation of the project.
- Lack or loss of quality riparian habitats.
- Project operations involving water fluctuations which may maintain and spread the invasion of noxious weeds throughout the area.
- The loss of, or reduction in, some micro habitats from dewatering and flooding.
- The potential effects of recreation on sensitive species and other wildlife resources.

7.3.1.3.2 Wildlife

The HCNRA provides an outstanding diversity of habitats for wildlife. This diversity is enhanced by the abrupt changes in vegetation resulting from changes in aspect, elevation, temperature, moisture, geology, soil depth, and the effects of fire and management activities. Approximately 372 wildlife species have been confirmed to occupy HCNRA (fish-42, salamanders-3, frogs/toads-9, snakes-10, birds-239, mammals-69). Riparian habitats, both wetland and terrestrial, are important to all wildlife species, many of which are either directly dependent on riparian zones or utilize them more than other habitats. One of the wildlife management goals for all riparian species in HCNRA is to maintain forested riparian buffers on streams, seeps, and springs.

Owls, bald eagle, peregrine falcon, Yuma myotis, little brown myotis, Townsend's big-eared bats, spotted bats, California wolverine, gray wolf, river otter, mule deer, elk, Canada geese, neotropical birds, and mountain quail should be considered of special importance or interest that could be affected by changes in river flows or reservoir elevations in Hells Canyon.

7.3.1.3.2.1 Raptors

Nine species of owls have been recorded as occurring in HCNRA. Most nest in or frequent upland forest. The western screech owl, however, is a nonmigratory, cavity nester associated with deciduous riparian forests of black-cottonwood, white alder, and quaking aspen and could potentially occur in the riparian zones situated along the Snake River.

Bald eagles were once numerous in Hells Canyon, but populations have severely decreased after the demise of most of the returning salmon runs. Winter eagle counts along the Snake River and Hells Canyon Reservoir have ranged from 3 in 1989 to 16 in 1994 and the general trend for wintering bald eagles has continued to increase. There are no known bald eagle nests within the HCNRA. Bald eagles tend to concentrate below Oxbow Dam and Hells Canyon Dam, where an abundance of fish die when passing through the turbines. Primary use of the river corridor is from November through March. Large trees and large rock outcrops adjacent to the water along the Snake River are important for perching.

One peregrine falcon nest is active within Hells Canyon at present (Wallowa National Forest, 1998).

7.3.1.3.2.2 Bats

Thirteen species of bats have been identified in HCNRA and two more species may possibly reach this area. The HCNRA contains buffers of uninterrupted canopy and snags which provide nursery, foraging, and hibernating habitat. Systematic investigations in HCNRA since 1984 have identified many sites of concentrated use by a variety of bat species along the Snake River corridor including maternity colonies of Yuma myotis, little brown myotis, populations of Townsend's big-eared bats, and spotted bats. One of the six significant maternity colonies of Townsend's big-eared bat in Oregon lies entirely within the HCNRA. Bats are voracious insectivores and play an important role as natural insecticides. The importance of these animals is reflected by the listing of three species as sensitive by ODFW and five species by IDFG. Seven of the 13 species are considered as possible candidates for Federal listing. Bats are very sensitive to change or disturbance in their environment. Any destabilizing influence has the potential to impact them heavily. Bats have a very low reproductive rate and they recover slowly, if at all,

from disturbance. Changes in river flows in the Snake River that would affect invertebrate production could have a profound affect on bat population within HCNRA.

7.3.1.3.2.3 Furbearers

Large important furbearers whose life history may be at least partly dependent on the riparian zone are wolverine, lynx, gray wolf, and river otter. California wolverines are considered rare throughout all of Oregon, Washington, and Idaho. They are known for their large territories and extensive traveling habits. Travel is generally along timbered ridges and stream bottoms such as the Snake River corridor. Surveys have shown that wolverines do exist in the HCNRA, but they are very rare.

Lynx are presently being considered for ESA listing by the USFWS. The USFWS and ODFW consider lynx populations in Oregon to be extirpated; however, recent surveys concluded that remnant populations may be present in the Wallowa National Forest and HCNRA. Wildlife management goals for the lynx include the maintenance of forested riparian buffers which the lynx may use as travel corridors.

In January 1995, gray wolves were transplanted from Canada to the Salmon River drainage in central Idaho. Because of that action, wolves and their habitats in central Idaho, including the Idaho portion of HCNRA, are now classified as experimental and nonessential to the recovery of wolves under the ESA. Gray wolf denning sites are usually located on moderately steep slopes with southerly aspects within close proximity to surface water. Wolves prey primarily on large ungulates such as elk and deer. The riparian zones along the Snake River corridor within the HCNRA could potentially provide both of these life history requirements and serve as a travel corridor.

River otter require a healthy riparian zone to provide cover, travel corridors, and denning sites as part of their life history requirements and can potentially be impacted by any changes in streamflows.

7.3.1.3.2.4 Mammals

Elk serve as a barometer of healthy habitats for big game species on the forest such as mule deer, white-tailed deer, bear, and cougar. Elk are native and were reported in the early 1800s in large numbers in the valleys around Baker, La Grande, and Enterprise, Oregon. Their numbers were seriously reduced during the late 1800s and reached a low by about 1910. Transplants from the Yellowstone area in 1912, and the introduction of hunting regulations, assisted in the recovery of elk in northeast Oregon. In 1980, ODFW established population objectives for elk management units: 3,800 for Snake River, 400 for Pine Creek, and 800 for Imnaha. Since then, elk numbers have been near these population objectives.

Habitat use by elk of the HCNRA starts in winter when elk are along the Imnaha and Snake Rivers or adjacent canyon rims. Some elk spend the entire year on the benches of Hells Canyon. IDFG estimates a current population of about 2,800 elk on the Idaho side that use HCNRA for at least part of the year. This herd of elk winters along the Snake River and summers in the high country between the Snake and Salmon Rivers. Mule deer also use the riparian habitats along the Snake River within HCNRA. Rocky Mountain big horn sheep are native to much of the mountain and canyon country in HCNRA and may occasionally utilize the riparian habitats for foraging activities. The sheep were exterminated in HCNRA by the early 1940's; however, reintroduction began in 1971 and continued through 1994. The reestablishment of bighorn populations has been subdued by reoccurring die offs due to pneumonia. Mountain goats are also present within HCNRA and may possibly frequent the riparian habitats for foraging activities.

7.3.1.3.2.5 Neotropical Migrants

A total of 114 species of neotropical migrants in the area have been identified. A preliminary assessment of the status and conservation priorities for Oregon neotropical migratory bird species identified 26 species in HCNRA that are known to have experienced long-term declines. This statewide assessment identified four priority habitats, including riparian zones, where species decline coexists with vulnerability to habitat loss. Special emphasis has been placed on mountain quail which is a game species whose population has been declining for unknown reasons. Research that includes using telemetry to determine movements and habitat requirements is presently ongoing. This research has shown a previously unknown periodic preference of mountain quail to the riparian habitats along the Snake River (Wallowa National Forest, 1998).

7.3.1.3.2.6 Waterfowl

Waterfowl in HCNRA mainly include diving duck species such as goldeneye and common merganser. Canada geese are the only nesting waterfowl species in HCNRA and are considered unique to this area. Canada geese have adapted to an unusual nesting habitat utilizing the sheer cliffs along the Snake River (Wallowa National Forest, 1998).

7.3.1.4 Grande Ronde River Basin

Riparian habitat degradation is a serious habitat problem in the Grande Ronde River basin. Approximately 379 degraded stream miles (main stem and tributaries) have been identified. However, riparian vegetation is well developed in valley areas where there is some protection from livestock grazing. Black cottonwood, white alder, several willows, and quaking aspen dominate these sites, but numerous shrubs also occur.

Private land along major streams in the Wallowa River valley where irrigation water and alluvial soils are present is devoted to farming or hay production. Marshes and ponds are small and scarce, but attract many migrating birds and some summer residents. Seasonally-flooded and subirrigated meadows make up the province's main wetland components. Some of these seasonally-wet meadows are rather extensive.

A wide range of wildlife species is known to regularly inhabit the basin. Riparian habitats support many eastern breeding neotropical birds that are otherwise rare in Oregon. Examples include veery, gray catbird, and redstart. These same areas also include black-chinned hummingbirds, broadtailed hummingbirds, and alder flycatchers.

The area also supports populations of elk and mule deer, as well as reintroduced populations of bighorn sheep and two introduced populations of mountain goats. Periodic sightings of wolverine, listed as threatened by ODFW, and the fisher, listed as sensitive by ODFW, are reported. Moose occasionally cross the Snake River from Idaho into Oregon.

7.3.2 Environmental Consequences

7.3.2.1 Base Case and No Augmentation Scenarios

There would be no significant effects on wetland associations from continuing flow augmentation at 427,000 acre-feet. No wetland effects have been evident as a result of this ongoing augmentation flow which causes minor fluctuations in reservoir water levels and streamflows. The vigor of emergent or riparian vegetative types has not been altered.

There would be no significant effects on wildlife or plant habitats (i.e. wetlands, riparian associations, and farmlands) from continuing the flow augmentation at 427,000 acre-feet. No wildlife, vegetation, or wetland effects have been evident as a result of this ongoing augmentation flow which causes minor fluctuations in reservoir water levels and streamflows. The vigor of emergent, riparian, and shoreline riparian vegetative types have not been altered, and there have been no significant changes to vegetative types and cropping patterns on agricultural lands.

7.3.2.2 1427i Scenario

Increased flows during the irrigation season resulting from an additional 1 MAF flow augmentation would improve the vigor of riparian woody and emergent vegetation along affected stream reaches. Some bank and backwater areas may be freshened by increased instream flows and experience improved growth and sustenance of wetland plants. Particular stream reaches which may benefit from these improved flows would be the Snake River downstream of Milner Dam, the lower Boise, Payette, Grande Ronde, and Salmon Rivers. Resident wildlife such as furbearers, amphibians, and waterfowl would benefit from improved habitat conditions. However, a measurable increase in total acres of riverine riparian wetland communities is not expected, nor would there be a significant increase in episodic flows to improve the regeneration of floodplain forests over the Base Case.

Under this scenario the water level fluctuations in affected reservoirs would be significantly altered from Base Case conditions. Some reservoirs would be drawn down more often and to lower levels than previously experienced to meet the demand for ongoing irrigation and increased streamflow. The probability for reservoir refill each year would also be decreased. Peripheral reservoir wetlands may be significantly affected in some reservoirs, especially those with large shallow areas and gradual, sloping bottoms. There may be a significant increase in exposed mudflats and the associated ephemeral wet meadow communities. There may be a decadence or loss over time of vigor and size in emergent and submergent wetlands and shoreline woody riparian species. Particular reservoir areas most affected may include Jackson Lake, Palisades, American Falls, and Cascade Reservoirs. Resident and migratory wildlife such as furbearers, amphibians, and waterfowl which depend on wetland and woody riparian habitats would be adversely affected. Migrating shorebirds may be benefitted by the increase in freshly exposed mudflats.

Under this scenario approximately 243,000 to 301,000 acres (table 6-11) of presently irrigated acres would no longer be irrigated. The affected lands would be fallowed or converted to dry land acres (i.e., grains or grazing lands). Fallow lands would be subject to weedy infestations until they were reseeded or, over many years, reverted back to native upland vegetation. Wildlife use of these affected lands would change significantly. There would be less overall wildlife use for nesting, feeding, and cover. There would be a change in species which would inhabit or frequent these lands depending on whether they remained fallow indefinitely or were reseeded and grazed by livestock.

Reductions in the basin of acres of irrigated agriculture may result in the loss or significant decadence of irrigation dependent wetlands, especially those associated with farm ponds, drainage channels, tailwater collection sites, and seepage sites dependent on groundwater fed by irrigation applications. These irrigation dependent wetlands would be in long established and concentrated flood irrigated tracts where there are more established wetlands. Such wetlands can be found in the middle Snake River basin and Grande Ronde River basin. Areas less affected per unit of irrigated agriculture taken out of production would be recently developed or isolated tracts, such as the highlift pump developments of the middle Snake River basin where few wetland types have been established or other areas where there is a concentration of sprinkler irrigation.

Irrigation applications improve plant growth and help plants recover from the impacts of grazing. Wet-pasture wetlands of the upper Snake, Salmon, and Grande Ronde River basins would suffer the least per unit of irrigated lands retired, but would be reduced in vigor and production.

Little opportunity would exist to mitigate for losses and adverse effects to wetland communities because available water sources would be extremely limited. This scenario would not meet the Federal goal for "no overall net loss" and it would be contrary to the Clean Water Action Plan's goal of achieving a net increase in wetlands each year.

7.3.2.3 1427r Scenario

Increased flows during the irrigation season resulting from an additional 1 MAF flow augmentation would improve the vigor of riparian woody and emergent vegetation along affected stream reaches in a similar manner as the 1427i scenario.

Fluctuations in reservoir water levels under the 1427r scenario would not be altered enough to significantly affect the vigor and size of peripheral or exposed wetland or riparian communities nor their dependent wildlife populations from the Base Case conditions.

The 1427r scenario would result in the reduction of 360,000 to 471,000 acres of irrigated agriculture (table 6-14). While this scenario would result in more acres of land taken out of irrigated agriculture in the middle Snake River than the 1427i scenario, impacts to other areas within the Snake River basin would be similar to those of the 1427i scenario. However, there would be significantly greater losses to wetlands and wildlife that are associated with irrigated agriculture along the middle Snake River.

There would be little opportunity to mitigate for losses and adverse effects to wetland communities because available water sources would be extremely limited. This 1427r scenarios would not meet the Federal goal for "no overall net loss" and would be contrary to the goal of the Clean Water Action Plan's to achieve a net increase in wetlands each year.

7.3.2.4 Summary

The No Augmentation scenario would have little effect on the wildlife, vegetation, or wetland communities of the affected area as compared to the Base Case. Scenarios 1427i and 1427r may result in improved streamside wetland and riparian habitat vigor due to improved downstream flows. Both scenarios would result in significant reductions of irrigated crops and increase in fallow lands and/or dry land crops and vegetation, with 1427r having the greatest effect--especially in the middle Snake River area.. There would be significant reductions in reservoir levels and carryover under the 1427i scenario, adversely affecting reservoir shoreline wetlands and riparian communities. More mudflats, used as feeding habitat by some animals, would be exposed.

7.4 Threatened and Endangered Species (ESA Species)

This section is arranged by species, rather than by stream reach, and discusses those species that are listed as threatened or endangered under the ESA. Salmon and steelhead are absent in the basin upstream of Hells Canyon Dam because the dam blocks upstream passage of these anadromous species. Salmon and steelhead are found in the Salmon River and Grande Ronde River basins and the current conditions are described. However, Reclamation chose to provide only brief subjective analysis of the scenarios for the Salmon and Grande Ronde River basins as those basins were not model.

A total of 21 federally listed T&E species have been identified as being present or possibly being present in the Snake River basin. In previous consultations with the USFWS, Reclamation eliminated several species from analysis after determining that they are: (1) not found within the areas influenced by Reclamation operations or (2) only occasionally found in these areas but not affected by Reclamation operations (Reclamation, 1998). The eliminated species are: gray wolf (*Canis lupus*), whooping crane (*Grus americana*), MacFarlane's four o'clock (*Mirabilis macfarlanei*), water howellia (*Howellia aquatilis*), Bruneau hot springsnail (*Pyrgulopsis bruneauensis*), and Banbury Springs lanx (*Lanx species*). In addition, Howell's spectacular thelypody *(Thelypodium howellia var. spectabilis*) and the Columbia spotted frog (Rana luteiventris), both candidate species, and the grizzly bear (*Ursus Arctos)* were eliminated from this analysis as not being affected by any of the flow augmentation scenarios. Reclamation (1998) found that project operations would not likely affect the Columbia spotted frog or grizzly bears, and Howell's spectacular thelypody is found only along the Powder River which is not included in this analysis of flow augmentation scenarios. Table 7-15 summarizes species, status, and location where found.

Table 7-15 ESA Federally Listed Species Found Within the Area and Considered in this Analysis

Common Name[1]	Scientific Name	Major Streams and Reservoirs Where Present
Federally Listed Endangered Species		
1 - American peregrine falcon	*Falco peregrinus anatum* and *Falco peregrinus tundrius*	Main stem and Henrys Fork including associated reservoirs, Lake Owyhee and downstream, Boise River and Payette Rivers including associated reservoirs.
2 - Snake River sockeye salmon	*Oncorhynchus nerka*	Lower Snake River downstream of Hells Canyon Dam; critical habitat designation, Salmon River
3 - Idaho springsnail	*Pyrgulopsis idahoensis*	Middle Snake River (Bancroft Springs to downstream of C.J. Strike Dam)
3 - Snake River physa	*Physa natricina*	Upper Snake River and middle Snake River (Jackson Bridge to Bancroft Springs)
3 - Utah valvata snail	*Valvata utahensis*	Upper Snake River and middle Snake River (from American Falls Dam to upstream of Lower Salmon Falls Dam)
Federally Listed Threatened Species		
1 - Bald Eagle	*Haliaeetus leucocephalus*	Main stem and Henrys Fork to Brownlee Dam including associated reservoirs; Ririe Lake/Willow Creek; Boise and Payette Rivers and associated reservoirs.
2 - Snake River spring/summer chinook salmon	*Oncorhynchus tshawytscha*	Lower Snake River (downstream of Hells Canyon Dam); critical habitat designation; Grande Ronde River, Salmon River
2 - Snake River fall chinook salmon	*Oncorhynchus tshawytscha*	Lower Snake River (downstream of Hells Canyon Dam); critical habitat designation, Clearwater River
2 - Snake River steelhead trout	*Oncorhynchus mykiss*	Lower Snake River (downstream of Hells Canyon Dam); Sweetwater Creek, Clearwater River
3 - Bliss Rapids snail	*Taylorconcha serpenticola*	Middle Snake River (Thousand Springs to King Hill/Clover Creek)
4 - Ute ladies' tresses	*Spiranthes diluvialis*	South Fork Snake River
2 - Bull trout	*Salvelinus confluentus*	Boise River; Payette River; Malheur River

Table 7-15 ESA Federally Listed Species Found Within the Area and Considered in this Analysis		
Common Name[1]	Scientific Name	Major Streams and Reservoirs Where Present
[1]Numbers indicate the following: 1 - Birds; 2 - Fish; 3 - Invertebrates; 4 - Plants		

Reservoir storage and riverflows are only two of many life history parameters that influence the presence of a threatened and endangered species at a particular body of water. Other factors may at times be more critical to a threatened and endangered species in selection of habitat. Therefore, classification of river/reservoir operations not conducive to a threatened and endangered species does not necessarily eliminate that species from that body of water.

For each species, one or more time periods in the life cycles were identified when the availability of water was deemed critical to the survival or life history maintenance. Minimum standards were identified for each species. The minimum standards and frequencies of occurrence were compared to the hydrologic modeling results for each scenario at locations identified to be occupied by a particular threatened or endangered species. The overall potential response of a species to changes in reservoir levels and/or riverflows was then evaluated for potential effect. Potential impacts were not determined for river reaches and reservoirs not included in the hydrologic model (see chapter 5).

7.4.1 American Peregrine Falcon

7.4.1.1 Affected Environment

The peregrine falcon remains listed as an endangered species; however, the comeback of the species has been so dramatic in recent years, that the species was recently proposed for delisting. The Peregrine Fund, Inc., instrumental in the artificial propagation program that led to the recovery of the species, has recommended that the species be delisted.

Peregrine falcon populations began a precipitous decline following World War II due to the widespread use of chlorinated pesticides, especially DDT and its metabolite DDE, which accumulated in peregrines because of feeding on contaminated prey. Adult mortalities increased, but the principal effect was damage to the reproductive potential through interference with calcium metabolism. The contaminants caused the thinning of eggshells, rendering them easily broken, and adversely affecting reproductive success. In 1973 the peregrine falcon was listed as an endangered species. Since the listing, the banning of harmful pesticides and the implementation of recovery efforts have gradually increased peregrine populations nationwide.

Other factors that have affected peregrine populations include shootings, natural predators (the great horned owl in particular), egg collecting, disease, collection by falconers, human disturbance at nesting sites, and loss of habitat to human encroachment.

7.4.1.1.1 Life History

Peregrine falcons generally reach sexual maturity at 3 years of age. Mating behavior and pair socialization have been classified into eight basic phases that occur over a courtship period lasting as long as 2 to 3 months. The bond between males and females is formed for the life of the pair. If one dies, the other often acquires a new mate and continues use of the nest site used by the original pair. This process may be repeated over many years, establishing a long period of historic use of traditional cliff nest sites.

Pairs usually establish nesting territories by March and lay a clutch of three or four eggs in late March and April. Incubation lasts about 33 days with a 2-day hatching interval between eggs. Young stay in the nest for 6 to 7 weeks and are not self-sufficient for several months. Hatching success in the wild is about 75 percent, with an average of one young reaching fledgling age per laying pair. Juvenile birds continue to be vulnerable during their first year as they learn to hunt and develop flying skills.

7.4.1.1.2 Nesting Habitat

Most nest sites are associated with water bodies and nests are generally located on a ledge or shallow cave on a cliff, which is the geographic and ecological center about which most of the mating behavior occurs. However, peregrines are also known to occasionally nest on slopes and river cutbanks, mounds, and occasionally sand dunes, flat bogs, and plains. They may sometimes nest in hollows of old and very large trees. Peregrines are also known to nest on manmade structures such as skyscrapers.

Rivers are significant to both the physical and biotic environment of the peregrine. Rivers may have created the nesting cliffs and provide ideal bathing areas, which are used frequently by peregrines. Gravel bars that slope gently into the river are the preferred bathing sites. Rivers also create conditions required by some prey species most frequently used by peregrines. Gravel bars and islands provide habitat for waterfowl and shorebirds, and shrubs on these sites provide habitat for passerine birds.

7.4.1.1.3 Foraging Habitat

Peregrines feed almost exclusively on birds captured in flight. These include ducks, upland game birds, shorebirds, and small perching birds. Prey species are usually hunted over open habitat types such as large rivers, reservoirs, fields, and wetland areas such as swamps and marshes. Peregrines have been known to prey on small mammals. Rock doves, mourning doves, and band-tailed pigeons are preferred prey, especially late in the nesting season.

Little information is available regarding habitat requirements of wintering peregrines. Migrant peregrines seem to be associated in areas where waterfowl are abundant. American peregrines remain within the Snake River basin states throughout the year and move locally on a seasonal basis in response to patterns of prey availability. Overwintering and migrant peregrines in the inland Northwest likely feed on concentrations of waterfowl and shorebirds near water bodies.

7.4.1.1.4 River System Factors Contributing to Species Decline

High water releases during the nesting season may inundate gravel bars, possibly reducing the attractiveness or suitability of nearby eyries. Storage of snowmelt runoff and the resulting attenuation of spring peak flows combined with the sediment-trapping properties of dams reduces the formation of new gravel bars and allows existing bars to become vegetated, possibly reducing the suitability of a river reach for nesting peregrines.

Waterfowl and shorebirds make up a large percentage of peregrine prey. Therefore, any operational features that negatively affect waterfowl or shorebird populations could have a detrimental effect on peregrine survival or reproductive success.

7.4.1.1.5 Base Case Conditions in Snake River Basin

Surveys for reestablishing pairs of breeding peregrines began in 1988. These initial surveys were conducted as part of a tristate cooperative project within that portion of Idaho referred to as the Greater Yellowstone Area (Levine, 1988). In 1990, the IDFG expanded surveys to other regions of Idaho.

In 1996, attempts were made to monitor nesting activities of all pairs of peregrine falcons discovered in Idaho (Levine and Melquist, 1996). Observations by personnel from the IDFG, the USFS, USFWS, and the BLM identified 17 occupied nesting territories in Idaho; 11 of the territories were in eastern Idaho. Four of the 11 pairs in eastern Idaho were successful in producing a total of 11 young. These productivity figures indicate a healthy, increasing population. With such a strong breeding population, the upper Snake River basin is a critical component in the recovery of Idaho's peregrine falcon population.

There are at least seven occupied territories in Wyoming that make use of the Snake River from Jackson Lake downstream to the Idaho State line. These eyries are regularly occupied and are some of the highest producing eyries in Wyoming. There are two to three peregrine nesting territories near Jackson Lake. Falcons from these territories forage at Jackson Lake and surrounding area. Little is known about winter use by peregrine falcons. In Teton National Park, breeding falcons begin to occupy nesting territories as early as April and leave sometime in October.

Three nesting territories have been documented along the main stem reach of the Snake River from the Wyoming border to the Henrys Fork. Surveys, although not always complete, have documented the production of more than 28 young from these sites since 1990. Two of the sites, both located on the river, have each produced a total of four young since 1990. The third site, located on Palisades Reservoir just north of Alpine, Wyoming, has produced over 20 young.

Two nesting territories along the Henrys Fork have been active since 1990. Since monitoring of these sites began in 1990, at least 21 young have been produced. One of these sites is a nesting tower erected as part of recovery efforts. Young were not successfully produced in 1995 and 1996. Information for 1997 and 1998 is not available. Nesting sites have not been found at Henrys Lake or Island Park Reservoir.

Nesting towers have also been erected at both the Camas National Wildlife Refuge and the Mud Lake Wildlife Management Area. Both sites are about 30 miles north, northeast of Idaho Falls, Idaho. Since their installation, these towers have seen only sporadic nesting attempts. In 1996, three young were produced at the Mud Lake site. Although not closely associated with the Snake River, a nesting tower at Market Lake, located about 20 miles north of Idaho Falls, has been periodically active since 1992, but has not successfully produced any young.

Peregrine falcons are found as occasional visitors and winter migrants in the American Falls area and up stream to the confluence with the Henrys Fork. While nesting has not been documented in the area, suitable habitat and food supply are present and adequate to support a nesting site (USFWS, 1993).

Peregrine falcons are occasional visitors and winter migrants throughout the reach from Milner Dam to American Falls Reservoir. While food supplies are probably adequate, suitable nesting habitat is lacking, and nesting has not been documented.

Peregrine falcons are winter migrants along the reach from Milner Dam to Brownlee Dam. Suitable cliffs for nesting are present, e.g., the Snake River Birds of Prey Natural Area, but other habitat factors such as availability of prey are evidently not suitable for nesting.

There are two known peregrine falcon nesting territories located in the Boise River basin. These are the Nampa Sugar Silo territory located about 5 miles south of the Boise River near Nampa, Idaho and the Key Bank nest located on an artificial platform atop a building in downtown Boise, less than 1 mile from the river (Levine and Melquist, 1996). The Nampa sugar silo territory has been very productive with

24 young produced since 1990. The Key Bank territory was first occupied in 1996 although a single adult female had been observed since 1994. This territory did not produce any young in 1996.

Although the Boise River is within foraging range of both nesting territories, monitoring of these birds indicate they rely mostly on prey such as rock doves and other upland birds in closer proximity to the nests (Beals, 1997).

Peregrine falcons are also found along the Boise River and its reservoirs as occasional migrants or wintering birds (USFWS, 1996a). These birds are most likely to be in areas where prey such as waterfowl and shorebirds are abundant.

There are no known peregrine falcon nesting territories near Cascade, Deadwood, or Black Canyon Reservoirs or river reaches downstream from those reservoirs (Levine and Melquist, 1996). Peregrine falcons were successfully released for several years from a site 6 miles east of Cascade Reservoir. Although nesting in the Cascade area has not been documented, sightings of adult birds at Cascade Reservoir in the summer provide evidence that a nesting territory may be nearby. USFWS (1996b) indicated that there was an historical nesting site located 19 miles south of Cascade at Tripod Peak.

The peregrine falcon is an occasional migrant visitor to the Cascade Reservoir area (Reclamation, 1991) and probably visits Deadwood and Black Canyon Reservoirs and river reaches downstream from these reservoirs.

Peregrine falcons are winter migrants at Lake Owyhee and along the Owyhee River downstream.

7.4.1.2 Environmental Consequences

Critical time periods for the peregrine falcon are: (1) the territory establishment period from January through March, (2) the breeding and incubation season from March through June, and (3) the hatchling/fledgling season from late April through September. Peregrine falcons feed on ducks, upland game birds, shorebirds, and small perching birds caught in flight. Factors that increase the abundance of prey species benefit the peregrine falcon.

Streamflows that create gravel bars are advantageous to peregrines which need suitable bathing habitat and adequate habitat for prey species. An increase of flows of 400 cfs or greater from January through June would be considered advantageous in creating and maintaining gravel bars. If riverflows decrease between January and June, vegetation would likely grow on existing gravel bars and new gravel bars may not be formed. It is not anticipated that any of the scenarios would significantly alter conditions in the upper reaches of the Snake River that would change the rate or amount of gravel bar creation or maintenance.

Current operations (Base Case) of Jackson Lake and Palisades Reservoir on the Snake River and reservoirs on the Henrys Fork may affect habitats and distribution of waterfowl and other prey populations but are not likely to adversely affect nesting peregrine populations. Operation and maintenance of project facilities have little or no effect on peregrine falcons because there are abundant or adequate prey populations to support migrant or wandering falcons.

Although there may be significant changes in reservoir pools under 1427i and significant reductions in irrigated agriculture under both the 1427i and 1427r scenarios, these impacts are not expected to significantly reduce prey base populations of waterfowl or shorebirds that nesting or migrant peregrine falcons rely on. Increase streamflows and more exposed mud flats at some reservoirs may, in fact,

improve prey populations in some localities and seasons. Therefore, it is unlikely that any of the scenarios would adversely affect the peregrine falcon.

7.4.2 Salmon and Steelhead

7.4.2.1 Affected Environment

Three anadromous fish species found in the Snake River basin are now listed under the ESA. These are fall and spring/summer chinook salmon, sockeye salmon, and steelhead. One or more of these anadromous fish species is found in the main stem Snake River between Hells Canyon Dam and Lower Granite Lake, the Grande Ronde River basin, and the Salmon River basin. Construction of the Brownlee, Oxbow, and Hells Canyon Dams blocked the upstream migration of all anadromous fish. As a result, there are no runs of salmon and steelhead upstream of Hells Canyon Dam.

Adult and jack fall chinook salmon of ages 2-5 years enter the Snake River from the middle of August through October and spawn from October through November. Viable spawning populations are dependent on quality and quantity of habitat and water temperature. Fall chinook eggs require continual submergence. Snake River fall chinook fry emerge from the spawning gravel in March through April and begin downstream migration within several weeks of emergence. Juveniles migrate downstream to estuaries where they may spend several months feeding before exiting the Columbia River plume. The timing of fall chinook juvenile migration depends on water temperature. Active upstream fall chinook migration begins when fork lengths reach 3.35 inches (85 millimeters). Juvenile fall chinook migrate past Lower Granite Dam from June through the fall with the peak migration usually in July. Juveniles probably continue to feed through midsummer in cooler waters of the main stem below the confluences of the Salmon and Clearwater Rivers. Fall chinook spawn principally in a 100-mile reach of the main stem from Hells Canyon Dam to Lower Granite Dam and in the lower reaches of the Salmon and Grande Ronde Rivers. Although fall chinook salmon are indigenous to the Grande Ronde River basin and were once widespread, current spawning is limited to a few fish in the lower main stem, primarily below the Wenaha River.

Spring and summer chinook salmon are the same species and are differentiated principally by migration and spawning habits. Life history data for wild spring and summer chinook is sparse. Spawners have been in the ocean for 2-3 years. Spring chinook spawners pass Bonneville Dam prior to June 1 while summer chinook spawners pass the dam between June 1 and August 1. The elevation of spawning streams is the primary factor influencing the salmon run and spawn timing. Many of the headwater tributaries of the North Fork Salmon River are critical spawning and rearing areas for spring chinook. Spring chinook are widely distributed throughout Grande Ronde River basin, but are declining even in some subbasins where habitat remains largely unaltered. Most spring/summer chinook spawners enter tributaries from May through September. Where the two runs coexist, spring chinook spawn earlier in the upper reaches of the tributaries. Water temperature differences associated with elevation may be the primary segregating factor for spring and summer spawning runs. Spring chinook may return and spawn earlier because they are adapted to spawn in colder water with eggs that require a longer incubation time. Juvenile spring/summer chinook emerge from the spawning gravels between February and June. After juvenile fish rear in the Snake River basin for about 1 year, they begin the seaward migration as smolts in April and May and migrate swiftly to sea (Matthews and Waples, 1991).

Adult Snake River sockeye salmon enter the Columbia River as early as April and usually after 3 years in the ocean; adults returning to spawn are 4-5 years old (NMFS, 1995) and are known to spawn in only one location. Migration up the Snake and Salmon Rivers can continue through October; however, most adults arrive at Redfish Lake in the Stanley basin in mid-July through August and spawn in beach gravel during

October (Bjornn et al., 1968). Eggs hatch after incubating for 80-140 days, and the fry remain in the gravel for 3-5 weeks, emerging in April through May to feed on plankton in the lake. Under the current program all sockeye spawners are captured and the fertilized eggs are used to support a captive broodstock program. Juveniles reared in the program are released to rear in the lake; they rear for 1-2 years before migrating seaward in the spring. Juveniles generally migrate past Lower Granite Dam in late May to mid-June. Once the smolts reach the ocean, they remain near the shore or within the plume of the Columbia River during the early summer months before moving out into the northeast Pacific Ocean. The migration timing for sockeye adults and juveniles is similar to that of spring/summer chinook adults and juveniles.

Inland Snake River steelhead, the anadromous form of resident redband trout, are summer-run fish which enter fresh water 9-10 months prior to spawning and ascend the Columbia River from June through October. Most juvenile steelhead in Idaho drainages rear in freshwater for 2-3 years, depending on water temperature and growth rates. Snake River steelhead have been classified into two groups based on ocean age, migration timing, and adult size. A-run steelhead generally spend an average of 1 year in the ocean. Sexually immature A-run summer steelhead enter freshwater in the spring and summer. Several months pass while they mature prior to spawning (NMFS, 1996). Adults enter the Columbia River on or before August 25 and attain a size of 4-8 pounds. These A-run steelhead are found throughout the Salmon and Grande Ronde Rivers. Summer steelhead spawn and rear throughout the Grande Ronde River basin by wild stock and a developing hatchery stock. Summer steelhead returns, which declined significantly through the 1970s and early 1980s despite reductions in harvest, have improved somewhat since 1985 with the advent of the fish transportation system and good flow years on the Snake and Columbia Rivers.

B-run steelhead spend an average of 2 years in the ocean. B-run winter steelhead mature in the ocean and enter freshwater in the fall and winter ready to spawn (NMFS, 1996). The adults enter the Columbia River after August 25 and grow to 12-20 pounds. Their range is limited primarily to the Clearwater River basin and the South and Middle Forks of the Salmon River. In the South Fork Salmon River, steelhead fry emerge from redds in the middle to late summer when they usually move into shallow, slow-moving margins of the stream. As growth continues, they adapt to areas with deeper water, a wider range of velocities, and larger substrate.

7.4.2.2 Environmental Consequences

Hydrologic modeling did not include the basin downstream of Hells Canyon Dam where these species are located. Overall analysis of potential benefits of flow augmentation in the lower Snake and Columbia Rivers on salmon and steelhead is within the province of the Corps' analysis.

The Base Case and No Augmentation scenarios have no effect on flows of the Grande Ronde and Salmon Rivers. The 1427i and 1427r scenarios would increase spring and summer flows by the same amount and would most likely improve habitat for salmon and steelhead in these streams.

7.4.3 Aquatic Snails

7.4.3.1 Affected Environment

The USFWS (1992b) listed five species of freshwater snails of the Snake River as threatened or endangered under the ESA, effective January 13, 1993. The Banbury Springs lanx (*Lanx sp.*), the Idaho springsnail (*Pyrgulopsis idahoensis*), the Snake River physa (*Physa natricina*), and the Utah valvata (*Valvata utahensis*) were listed as endangered. The Bliss Rapids snail (*Taylorconcha serpenticola*) was listed as threatened. All five species are characterized as geographically limited and generally intolerant of pollution.

The USFWS (1992b) reported that four of the taxa had declined in all but a small fraction of their historical range. They further stated that the five species were currently restricted to a few isolated free-flowing reaches or spring alcove habitats in the middle Snake River characterized by cold, well-oxygenated, unpolluted water. They defined the middle Snake River as extending from C.J. Strike Reservoir upstream to Milner Dam.

Recent IPC and Reclamation studies have shown that two snails are more widely distributed than thought at the time of listing. The Idaho springsnail has been found in the Snake River at C.J. Strike Reservoir and 20 miles downstream from C.J. Strike Dam. The Utah valvata snail has been located throughout Lake Walcott and upstream to a point about 2 miles downstream from American Falls Dam. Additional investigations in October 1998 found the Utah valvata snail in American Falls Reservoir. IPC and Reclamation, within the last few years, have found ESA-listed aquatic snails throughout most of a 215-mile reach of the Snake River.

7.4.3.1.1 Bliss Rapids Snail

The Bliss Rapids snail is 0.1-inch high with three whorls and is ovoid in shape. Shell color variants include a pale (colorless) form and an orange-red form. The pale form is slightly smaller with rounded whorls and more dark brown or black pigment (melanin) on the body (Frest and Johannes, 1992).

The reproductive organs of this species are distinctive and individuals are either male or female. The snails mate in October-February in the main stem Snake River and in February-May in associated large springs. Eggs are laid within 2 months of mating and hatch within a month. Adult snails usually exhibit a strong die-off of older individuals in the late winter-early spring season following reproduction. Turnover following reproduction has been reported to be more pronounced in main stem river colonies.

The Bliss Rapids snail requires cold, clean, well-oxygenated, swiftly-flowing water with low turbidity. It prefers stable, cobble-to-boulder sized substrate, will not burrow, and avoids surfaces with attached plants. The USFWS (1992a) reported that known colonies are found only in areas associated with springs or at the edge of rapids and tend to flank shorelines. The snail is negatively phototaxic (avoids light) and resides on lateral and undersides of rocks during the daylight. It is often found grazing on algae and diatoms on the tops of rocks and is found at varying depths if dissolved oxygen and temperature conditions are favorable.

In 1993, a landslide caused water levels to rise and large amounts of sediment to be deposited in an area south of Bliss (RM 560). Known colonies of the Bliss Rapids snail were present in this area. However, the magnitude of impact to the Bliss Rapids snail in this area is unknown.

Current Reclamation operations are not likely to adversely affect the Bliss Rapids snail and IPC could not document any decline in snail population density and distribution or impaired reproduction (Reclamation, 1998).

7.4.3.1.2 Idaho Springsnail

The Idaho springsnail, also known as the Homedale Creek springsnail, has a narrowly elongated shell reaching a height of 0.2-0.25 inch and containing as many as six whorls. The empty shell has a pale, olive-tan color but can appear white at the apex. The body is gray with a reddish-brown aperture. Little is known of the general life history of this species; research is needed. The individuals are either male or female, and it is thought that the snails live up to 1 year. Based on typical patterns for many coldwater snails in the Pacific Coast states, the snails likely breed in February-May and eggs are laid and hatch in March-July. The eggs are laid in single capsules attached to the outside of the shell.

The population size of this species is not known. It has been reported that all samples of the Idaho springsnail represent a single population, based on similarities in glands among all samples.

Information collected by early investigators showed that in general, the Idaho springsnail requires cold, clean, well-oxygenated flowing water with low turbidity. The species occurs on mud or sand associated with gravel-to-boulder size substrate (USFWS, 1992a). It is often attached to vegetation (e.g. *Potamogeton*) in riffles.

Current operations appear to have no effect on the Idaho springsnail as habitat is not currently threatened and no decline in snail population density or distribution could be documented (Reclamation, 1998).

7.4.3.1.3 Snake River Physa

The shell of the adult Snake River physa is 0.2-0.25 inch in height with three to three and one-half whorls and is amber to brown in color (USFWS, 1992a).

Little is known of this species and research is needed. However, this snail, like all pulmonates, is hermaphroditic (possess both male and female sexual organs). Assuming this snail is similar to related species and other pulmonates, it lives for 1-2 years. Based on typical patterns for many coldwater snails in the Pacific Coast states, the snails probably breed in February-May and eggs are laid and hatch between March and July.

The Snake River physa requires cold, clean, well-oxygenated, swiftly flowing water with low turbidity. It occupies areas with rock and boulder substrate in deep water at the margins of rapids, where it occurs on the underside of the substrate. The snail is believed to inhabit deep water beyond the range of routine sampling (USFWS, 1995a).

The effects of current operations on the Snake River physa is unknown as the species remains reclusive and largely unsampled (Reclamation, 1998).

7.4.3.1.4 Utah Valvata Snail

The shell of the Utah valvata is turbinate and contains as many as four whorls, bordered by an angular ridge that fades toward the circular aperture. There are fine transverse, raised threads on the shell that is typically 0.2 inches in height.

This snail consumes diatoms, small plant debris, aquatic plants or other sessile organisms and resides among submerged aquatic vegetation.

The reproductive biology of the species has not been well documented and research is needed. Unlike some prosobranch snails, this species is hermaphroditic. This species is believed to have a maximum longevity of 2 years, based on age structure of sampled populations, although a majority are thought to survive only a single year. Eggs are likely laid in March-June in masses generally attached to macrophytes near the substrate.

Surveys at the Thousand Springs Preserve in 1991 revealed that only two areas contained colonies of the Utah valvata snail. The population estimate was 6,000 snails per colony with an average population density (in 1991) of six snails per square quarter meter. Subsequent surveys have discovered additional population at Lake Walcott and American Falls Reservoir.

The USFWS (1992a) reported that in the Snake River, the Utah valvata inhabit shallow shoreline waters, deep pools adjacent to rapids, and perennial flowing waters associated with large spring complexes. It generally avoids areas with heavy currents or rapids. The species prefers well-oxygenated areas of non-reducing calcareous mud or mud-sand substrate among beds of submergent aquatic vegetation. The species is absent from pure gravel-boulder bottoms. *Chara*, which concentrates both calcium and silicon dioxide, is a common associate.

Under current operations, normal drawdown of Lake Walcott is likely to adversely affect a portion of the population in the reservoir, but a large viable portion of the population appears to be thriving in deeper water not subject to dewatering. Populations downstream of Minidoka Dam should not be adversely affected, if recovery occurs and snails return to areas impacted by record flows of 1997. Routine operation of American Falls Dam is not likely to adversely affect the downstream population. IPC could not observe or document any decline in the snail population density and distribution downstream of Milner Dam (Reclamation, 1998).

7.4.3.2 Environmental Consequences

Critical time periods and minimum standards (flows, changes in flows, and drawdown of reservoirs) were developed based primarily on professional judgement to analyze potential effects of the scenarios. Standards for Lake Walcott and C.J. Strike Reservoir were based primarily on the amount of drawdown. Standards for releases from Milner Dam, flows at Hagerman, and releases from C.J. Strike Dam were developed based on the consistency of flows. These flow standards were developed for four levels– beneficial (enhancement), acceptable (current maintenance level), caution (adverse effect), and not good (very adverse).

For this analysis all of the aquatic snails were considered as a unit.

7.4.3.2.1 Lake Walcott

All of the scenarios were deemed to provide an acceptable level of effect.

7.4.3.2.2 Milner Dam Releases

Flows during the months of July, August, and September were rated as acceptable or beneficial to aquatic snails under all scenarios, and flows during the month of June were rated as not good under all scenarios. Overall the No Augmentation scenario achieves the steady flow condition suitable for snails. The higher augmentation flows that would be necessary to implement either the 1427i or 1427r scenario would make

it very difficult, if not impossible to achieve the gradual ramp-down of flows that occurs under the base case.

7.4.3.2.3 Flow at Hagerman

Flows during June, July, and September were rated as beneficial for all scenarios, and flows during August were rated as beneficial for the Base Case and the No Augmentation. Flows during August were rated as not good for the 1427i and the 1427r scenario.

Flows during June, July, and September under all scenarios were rated as beneficial and flows during August under the Base Case and the No Augmentation were rated as beneficial. Flows during August would increase substantially under the 1427i and 1427r scenarios and were rated as not good; temporary habitat along shorelines would be created and later dewater after down ramping.

7.4.3.2.4 C.J. Strike Reservoir

Reservoir content data was not available, so an analysis of effects was not made.

7.4.3.2.5 C.J. Strike Releases

Flows during the months of June and July were rated as beneficial under all scenarios. Flows during the months of August and September were rated as cautionary for the Base Case, beneficial and cautionary for No Augmentation, not good and cautionary for the 1427i and 1427r scenarios. In summary, the 1427i and 1427r scenarios would likely be adverse to aquatic snails downstream of C.J. Strike Dam owing to the oscillation in flow releases.

7.4.4 Bald Eagle

7.4.4.1 Affected Environment

The bald eagle is currently listed as threatened in all of the lower 48 contiguous states. Historically, the bald eagle could be found nesting throughout most of the continent. However, reproduction in North America declined dramatically between 1947 and 1970 largely due to intake of DDT (USFWS, 1986). Habitat degradation, illegal harassment and disturbance, poisoning, and a reduced food base helped contribute to the decline. By 1978, the bald eagle was federally listed as a threatened species in 5 of the lower 48 states and as an endangered species in the remaining lower 43 states.

In establishing a recovery program for the species in the mid-1970s, the USFWS divided the bald eagles of the lower 48 states into five recovery regions. A recovery plan was prepared for each region by separate recovery teams composed of species experts in each geographic area. The teams set forth goals for recovery and identified tasks to achieve those goals. The Snake River basin lies within the Pacific recovery region that includes the states of Idaho, Oregon, Washington, Montana, Wyoming, California, and Nevada. The bald eagle recovery plan for the Pacific Region was approved in 1986.

In the 17 years since it was listed throughout the conterminous 48 states, the bald eagle population has clearly increased in number and expanded in range. The improvement is a direct result of banning DDT and other persistent organochlorides, habitat protection, a growing public awareness of the bald eagles' plight, and other measures. Due to the overall population increase, the bald eagle was reclassified from endangered to threatened in all of the lower 48 states in 1995 (USFWS, 1995b).

In 1990, bald eagles nested in all but 5 of the 50 states. However, most bald eagle nesting is limited to the Pacific Northwest, Alaska, Canada, the Great Lake states, Chesapeake Bay, Arizona, and Florida. Oregon and Washington have been strongholds for bald eagles with more than two-thirds of the nesting population and one-half of the wintering population of the Pacific recovery region occurring in these two states (USFWS, 1994). Occupied breeding territories surveyed in Oregon and the Washington portion of the Columbia River recovery zone have increased from less than 100 in 1979 to 330 in 1997 (Isaacs and Anthony, 1997). The number of known occupied nesting territories in Idaho have increased from 11 in 1979 to 90 in 1996 (IDFG, 1997). Delisting of the species is now a potential.

Delisting requirements under the Pacific Bald Eagle Recovery Plan include: (1) a minimum of 800 nesting pairs; (2) an average reproductive rate of 1.0 fledged young per pair with an average success rate per occupied site of not less than 65 percent; (3) breeding population goals met in at least 80 percent of the management zones; and (4) stable or increasing wintering populations. These goals have been met in the Pacific States, and bald eagle numbers are continuing to increase. In 1994, a total of 1,192 occupied territories were reported with 1.03 young per occupied territory. The number of occupied territories has consistently increased since 1986 and exceeded 800 for 5 years beginning in 1990 when 861 were reported. Productivity has averaged about 1.03 young per occupied territory since 1990. In 1994, 21 of the 37 specified management zones had met or exceeded their recovery goals for breeding, and five zones, that are in addition to the original 37 zones and are not part of the recovery goals for this region, also had nesting eagles. Delisting goals have been met in all categories except distribution in zones with nesting targets.

7.4.4.1.1 Life History

The bald eagle, like most birds of prey, exhibits sexual dimorphism with the females weighing more than the males. Males and females are thought to mate for life, returning to the same nesting territory year after year. A clutch of one to three eggs, is laid and incubated mostly by the female for about 35 days. The young fledge in 72-75 days. Often the younger, weaker bird is killed by its sibling in the competition for food.

Bald eagles require 4-5 years to reach sexual maturity and attain full adult plumage. Prior to that time, immature bald eagles are often confused with immature golden eagles.

7.4.4.1.2 Nesting Habitat

In the Pacific Northwest, bald eagles typically nest in multilayered coniferous stands with old growth trees within 1 mile of large bodies of water (lakes, reservoirs, large rivers, and coastal estuaries). Availability of suitable trees for nesting and perching is critical. Nest trees in the Pacific Northwest are found primarily in ponderosa pine, mixed conifer, Douglas fir, and Sitka spruce/western hemlock forests (USFWS, 1986). Species of trees used for nesting, however, vary among areas. In Idaho, nests are typically found in large cottonwoods, ponderosa pines, and Douglas firs (USFWS, 1986). Wyoming nests have been reported in a variety of forest types including old growth ponderosa pine and narrow strips of forest vegetation surrounded by rangeland. Nests are generally not constructed in areas with nearby human activity.

The nesting season for bald eagles in the Pacific Northwest generally extends from January 1 to mid-August (USFWS, 1994). Young are usually produced in March and fledged in July; however, they may stay near the nest for several weeks after fledging.

7.4.4.1.3 Wintering Habitat

More than 25 percent of the wintering bald eagles in the lower 48 states are present in the Pacific Northwest (USFWS, 1986). Bald eagles winter in the Northwest from approximately November through March and are primarily associated with open water near concentrated food sources. An important habitat feature is perch trees which provide an unobstructed view of the surrounding area near foraging sites (USFWS, 1986). Ponderosa pine and cottonwood snags are preferred perches in some areas, probably due to their open structure and height.

Bald eagles may also use communal night roost sites in winter for protection from inclement weather. Characteristics of communal winter roost sites differ considerably from those of diurnal perch sites (USFWS, 1986), although both are invariably located near concentrated food sources, such as anadromous fish runs or high concentrations of waterfowl. Roost sites tend to provide more protection from weather than diurnal perch sites. Communal roosts in the Pacific Northwest tend to be located in uneven-aged forest stands with some degree of old-growth forest structure. Conifers might provide a more thermally favorable microenvironment than dead or deciduous trees, which might explain their high use by wintering eagles. In eastern Washington, bald eagles have been observed roosting in mixed stands of Douglas fir and ponderosa pine and in stands of black locust and black cottonwood.

7.4.4.1.4 Foraging Habitat

Bald eagles are opportunistic foragers throughout their range. In the Pacific Northwest, bald eagles consume a range of food including a variety of fish, waterfowl, jackrabbits, and mammalian carrion (USFWS, 1994). Game and nongame fish species tend to be the preferred food, but diet is dependent on prey availability. Winter killed mammals can be important on big game winter ranges, while waterfowl are important where concentrations are significant. Fish are also taken as carrion, especially spawned out kokanee (USFWS, 1986).

7.4.4.1.5 Base Case Conditions

The Snake River basin upstream of Milner Dam supports a significant population of nesting and wintering bald eagles. It is the largest nesting population of bald eagles in the State of Idaho. The nesting population of bald eagles in this area has increased steadily since 1970 (Greater Yellowstone Bald Eagle Working Group, 1996). In 1979, there were an estimated 11 occupied nest sites in Idaho. Annual monitoring efforts indicate that the number of known occupied nesting territories in eastern Idaho has increased dramatically over the last 18 years. In 1996, there were 46 known occupied nesting territories in eastern Idaho alone and 90 sites Statewide (Beals and Melquist, 1996). On the Idaho portion of the Snake River upstream of Milner Dam, a series of 13 routes have been surveyed on an annual basis during the National Mid-Winter Bald Eagle Count. While wintering populations of bald eagles in Idaho have been monitored regularly since 1980, the information gained from this survey has limitations in its use. The total number of eagles for these 13 routes collectively has ranged from a low of 49 to a high of 241. Many variables, including weather conditions and inconsistency of route surveyors, make the interpretation of the data difficult. It is not possible at present to identify a clear trend of increasing or decreasing use of the Snake River in Idaho by wintering bald eagles.

The Snake River main stem from Milner Dam to Brownlee Dam includes only two nesting territories, but receives significant winter use. Complete counts conducted over the last 10 years show numbers ranging from 25 to 56 eagles on the river upstream of Brownlee Reservoir. Most of the wintering eagles are found in the reach from Milner Dam to Grandview. Brownlee Reservoir is heavily used by wintering bald eagles. Winter counts generally are 25 to 50 birds but have been more than 100 in a couple of years (Isaacs et al., 1992).

The Boise River basin includes only a few bald eagle nests but is considered an important wintering area from Anderson Ranch Reservoir to the lower Boise River, including Lake Lowell. As many as 50 eagles winter in the upper river area which include Anderson Ranch Reservoir, Arrowrock Reservoir, and Lucky Peak Lake. Up to 35 individuals can be found along the river reach downstream of Lucky Peak Dam and as many as 20 individuals can be found at Lake Lowell.
Cascade Reservoir in the Payette River basin is considered an important nesting area with six active nesting territories, and the South Fork and main stem Payette River are considered important wintering areas with respective population counts of up to 16 and up to 20 birds.

There are no known nesting sites at Lake Owyhee and along the lower Owyhee River; however, up to 30 eagles winter at the reservoir and lower river.

Bald eagles are found at ten reservoirs: Jackson Lake, Palisades, Island Park, American Falls, Anderson Ranch, Arrowrock, Lucky Peak Lake, Cascade, Deadwood, and Lake Owyhee. Bald eagles have also been identified in the following river reaches: Snake River downstream of Jackson Lake Dam, Snake River at Irwin, Heise, and Lorenzo; South Fork Boise River at Anderson Ranch Dam; Boise River downstream of Lucky Peak Dam; North Fork Payette River downstream of Cascade Dam; Deadwood River downstream of Deadwood Dam; and Payette River at Horseshoe Bend. Bald eagles are also found along the main stems of the Grande Ronde and the Salmon Rivers.

Current operation of Reclamation facilities has little or no adverse effects on bald eagles at most locations because there are abundant or adequate prey populations to support the current level of nesting and winter use (Reclamation, 1998). Flood control operations tend to limit cottonwood regeneration downstream of Palisade Dam, Anderson Ranch Dam, Lucky Peak Dam, and Owyhee Dam. However, there continue to be adequate perching and roosting sites.

7.4.4.2 Environmental Consequences

Successful bald eagle foraging may be more closely linked to the abundance of prey species than to reservoir levels. The bald eagle's dependency on fish and its association with large bodies of water has been well documented. Stable reservoir levels during the hatchling and fledgling period provide a secure food source on a day-to-day basis. As full reservoirs decline in size, prey fish are found either concentrated in shallow waters or perhaps trapped in shallow pools allowing for easier vulnerability to foraging and thus good fishing success by eagles. However, this condition is usually temporary in nature and if continually repeated, seasonally or annually, would have a net negative effect on the prey and the eagle.

Overall, an open body of water providing greater shoreline shallows for expanded foraging are of immense benefit to eagles in the spring. A larger water surface is more substantially affected by wind conditions allowing for better ice break up and a better mix of warmer surface waters with colder deep waters. Higher reservoir levels improve foraging conditions for predatory fish as well as for eagles. Eagles also benefit from trout spawning runs in April through June when these fish are more surface oriented at lakes or more readily exposed in clear, shallow streams. Decreasing reservoir levels may concentrate prey fish as the summer progresses, although these fish may tend to avoid surface waters being wary of avian predators, thus lowering foraging success rates.

For this analysis, three critical time periods–breeding (March and April), incubation/hatchling (April and May), and winter (November through March)–and minimum reservoir elevations (pool sizes) were identified. Riverflow standards were also identified. Based on how often the scenarios meet these levels, the scenarios were determined to be either conducive, not conducive, or at a cautionary level for bald

eagles. Table 7-16 summarizes the ratings for 10 reservoirs based on pool size and 10 river reaches based on flow.

Table 7-16 Overall Rating of Scenario Effects on Bald Eagles				
Location and Benefit Level	Scenarios (number of locations (of 10 possible))			
	Base Case	No Augmentation	1427i	1427r
Reservoirs				
Conducive	4	3	1	3
Not Conducive	6	6	8	6
Cautionary	0	1	1	1
River Reaches				
Conducive	7	7	7	7
Not Conducive	2	2	2	2
Cautionary	1	1	1	1

Table 7-16 indicates that reservoir levels would be most favorable for bald eagles (conducive at 4 of 10 reservoirs) under the Base Case, slightly less favorable under the No Augmentation and 1427r scenarios and least favorable under the 1427i scenario (conducive at only one reservoir). Riverflow levels under all scenarios would be conducive (7 of 10 reservoirs) to bald eagles.

Other factors, including weather, food supply, and habitat availability (perching trees, nesting trees, and big game range foraging areas), have been documented to contribute significantly to the welfare of the bald eagles and may negate the single influence of the minimum reservoir storage or minimum riverflow standards. It has been further documented that weather-related factors may often have more influence on bald eagle reproductive success than fluctuations in reservoir levels.

7.4.5 Ute Ladies' Tresses

7.4.5.1 Affected Environment

Ute ladies' tresses was listed as a threatened species on January 17, 1992. Individual populations of this orchid are known to exist in Idaho, Colorado, Utah, Wyoming, and Nevada. The total known population is approximately 20,500 individuals. The population is probably declining due to limited habitat. The existing habitat is relatively small, potential habitat is being lost, and processes that cause new potential habitat to develop are impeded. Nonetheless, extensive searches of potentially suitable habitat have revealed a greater number populations and individual Ute ladies' tresses plants than was known when the plant was listed in 1992.

The number of plants present in any specific population may vary considerably from year to year and may lead to false estimates of the population size and vigor. Fluctuations in populations are the result of dormancy periods likely brought on by variation in environmental conditions. During dormancy periods, there may be limited above-ground growth and no floral development.

An approved recovery plan for the Ute ladies' tresses has not been developed.

7.4.5.1.1 Life History

The Ute ladies' tresses is a perennial, terrestrial orchid with stems arising from tuberously thickened roots. Its narrow leaves are about 11 inches long at the base and become reduced in size toward the apex. The flowers consist of few to many small white or ivory flowers clustered into a spike arrangement at the top of the stem.

This species usually flowers from the end of July until early September. Reproductively mature plants do not flower every year, probably because of variations in environmental conditions. Reproduction appears to be strictly sexual, with bumblebees as the primary pollinators. Each fruit contains thousands of very small seeds. Seeds disseminate primarily through water transport. After seeds reach suitable habitat, they must come in contact with the suitable species of mycorhizal endophyte. This fungus provides the developing plant with the nutrients necessary for further growth. Plants usually require 5 to 10 years before flowering.

7.4.5.1.2 Habitat Requirements

Ute ladies' tresses appears to be well adapted to, and perhaps dependent on, regular disturbances caused by water movement through floodplains. Natural fluvial processes create new habitat. Flooding also maintains the existing habitat by reducing colonization of gravel bars by trees and shrubs.

The orchid is endemic to moist soils in mesic or wet meadows nears springs, lakes, or perennial streams. The elevational range of known Ute ladies' tresses is 4,300 and 7,000 feet (Stone, 1993). The plant is found mostly along riparian edges, gravel bars, old oxbows, and moist to wet meadows along perennial streams. In some localities in the eastern Great Basin, Ute ladies' tresses are found near freshwater lakes or springs. The plant seems to require permanent sub-irrigation (Coyner, 1989), indicating a close affinity with floodplain areas where the water table is near the surface throughout the growing season. It grows primarily in areas where the vegetation is relatively open and not overly dense or overgrown (Coyner, 1989 and 1990; Jennings, 1989 and 1990), although a few populations in eastern Utah and Colorado are found in riparian woodlands. Plants usually occur in small scattered groups and occupy relatively small areas within the riparian system (Stone, 1993). These preferred habitat features seem to imply that the plant is most likely to occur in riparian habitats created and maintained by streams active within their floodplains.

Ute ladies' tresses appear to have a very low reproductive rate under natural conditions. This orchid is tolerant of a mix of herbaceous wetland, forb, and grass species but does not compete well with emergent or aggressive species that form dense monocultures, such as Canada thistle, purple loosestrife, whitetop, Russian olive, and reed canarygrass. Maturing riparian communities with an overstory of trees or shrubs do not provide suitable habitat conditions. The plants thrive in full sun or partial shade. It is not tolerant of long-term standing water throughout the growing season. Beaver dams that raise the water table to within 18 inches of the ground surface likely improve habitat conditions in adjacent areas.

Ute ladies' tresses are found in two types of plant communities in the project area. These communities consist of the wandering spike-rush and the silverberry/coyote willow communities. The wandering spike-rush community where Ute ladies' tresses have been found is nearly monotypic. The silverberry/coyote willow community is a mesic transition zone habitat between sedge dominated areas with standing water and habitats higher in elevation that have an overstory of narrow leaf cottonwood and an understory of Kentucky bluegrass. Habitat is commonly dominated by redtop, a non-native, rhizomatous grass, with an overstory of widely scattered silverberry and coyote willow (Moseley, 1996). Shrub canopy averages less than 10 percent. Soils are generally fine to coarse alluvium, with minimal soil development.

7.4.5.1.3 Base Case Condition

Ute ladies' tresses were found in Idaho in September, 1996 (Moseley, 1996). Extensive surveys in 1996 covered a wide area of eastern Idaho to assess the distribution of potential habitat. These surveys documented the existence of four separate occurrences of the plant in the floodplain along the main stem of the Snake River between Heise and Swan Valley. One population consisted of 12 individuals scattered over an area of about 1 acre while another population consisted of 15 individuals within an area of about 1 acre. The largest population was 173 plants within a 1 acre area, while the smallest population was one plant at another site.

The IDFG Conservation Data Center, Bureau of Land Management (BLM), USFS, and USFWS conducted more intensive surveys in 1997. Preliminary analysis of data indicates the existence of 20 occurrences along the Snake River between Swan Valley and the confluence with the Henrys Fork (Moseley, 1997). A total of 1,171 individuals (mostly flowering/fruiting plants) were counted. Non-flowering plants were not counted due to the difficulty of species identification.

Grazing and recreational use appear to be the most likely activities affecting the plant. However, adequate data is not available to determine what, if any, activities are affecting this species along the main stem Snake River. It is generally believed that any activity that degrades floodplain riparian or wetland habitats would also affect Ute ladies' tresses (USFWS, 1995c).

Reclamation is currently cooperating with BLM and other agencies in a study to document river morphology changes of the Snake River that may have resulted from 1997 floodflows downstream from Palisades Reservoir. This study is expected to provide some understanding of the effects of periodic flood events on the habitat of the Ute ladies' tresses.

Reclamation concluded that the Base Case operation is not likely to adversely affect Ute Ladies' Tresses (Reclamation, 1998).

7.4.5.2 Environmental Consequences

Critical time periods and minimum flow standards were identified based primarily on professional judgement. The critical time period for the Ute ladies' tresses is May through July and the minimum standard is that riverflows should average near 20,000 cfs or higher in the Snake River between Swan Valley and Heise in any one of three months (May, June, or July) and should occur at least 50 percent of the time or in 3 of 6 six-year periods. Four effect levels were developed based on how the standard was met–beneficial, acceptable, cautionary, and unacceptable.

Reclamation found that flow conditions at Heise would be acceptable (no effect) under all four scenarios. In contrast, flows at Irwin would be acceptable under the Base Case, but unacceptable under the No Augmentation,1427i, and 1427r scenarios because river flows in the latter three scenarios would not meet the minimum standard.

7.4.6 Bull Trout

7.4.6.1 Affected Environment

The Columbia River population segment of bull trout has been listed as threatened. Bull trout populations within this population segment have declined from historic levels and are generally considered to be isolated and remnant.

7.4.6.1.1 Historical Distribution

Bull trout were probably widely dispersed throughout the Snake River drainage, limited only by natural passage and thermal barriers. Bull trout were present in all of the Snake River basin (except the eastern section of Idaho) and tributaries of the upper Columbia River basin. In the Snake River basin, their historical range approximates that of spring, summer, and fall chinook salmon (Thurow, 1987; Rieman and McIntyre, 1993) and possibly included the Owyhee River basin and other Snake River tributaries upstream as far as Salmon Falls Creek. They are not known to have occurred in the Snake River upstream of Shoshone Falls, the Wood River system, Birch Creek, or any stream in Idaho that drains the Centennial Mountains between Henrys Lake and the Bitterroot Range. An isolated population exists in the Little Lost River near Howe, Idaho between the Lost River and Lemhi mountain ranges (Batt, 1996).

In eastern Oregon, bull trout were present in the Grand Ronde, Powder, and Malheur River systems, but were not known to occur in the Burnt River system.

7.4.6.1.2 Present Distribution

Current distribution is primarily in tributaries to the main stem Snake River upstream to and including the Boise River. Major tributaries of the Snake River in Oregon currently supporting bull trout populations include the Grande Ronde, Imnaha, and the Malheur. In Idaho, bull trout can be found in the Clearwater, Salmon, Weiser, Payette, and Boise River drainages.

Reclamation reservoirs in Idaho that are known to have bull trout associated with them are Arrowrock Reservoir, located on the main stem Boise River; Anderson Ranch Reservoir, located on the South Fork Boise River; and Deadwood Reservoir, located on the Deadwood River in the Payette River basin.

Survey work has recently documented bull trout in widely scattered segments of their known range in eastern Oregon, mostly in headwater areas where only remnant resident populations may be surviving (Batt, 1996). Bull trout are present in two headwater areas of the Malheur River. In the main stem, bull trout are confined to headwater areas several miles upstream of Warm Springs Reservoir. There are no documented populations of bull trout in Warm Springs Reservoir. The North Fork Malheur River basin supports bull trout from Beulah Reservoir upstream to and including headwater tributaries. Beulah Reservoir supports an adfluvial population of bull trout that migrates to headwater tributaries during spawning periods.

Isolated headwater populations of bull trout exist in the Powder River basin. However, there has been no documentation of bull trout associated with Reclamation facilities (Phillips Lake and Thief Valley Reservoir) in this basin. Bull trout have not been documented by ODFW in the Burnt River system (Zakel, 1997)

7.4.6.1.3 Life History

Bull trout exhibit two distinct life history forms in the Snake River basin–migrant and resident. Migrant fish emigrate from the small streams where the juveniles rear to larger rivers (fluvial) or lakes (adfluvial). Resident fish remain in the rearing streams. Table 7-17 (Knowles and Gumtow, 1996) summarizes the life history of bull trout.

Table 7-17 Bull Trout Life History Summary	
Life Conditions	**Criteria/Facts**
Age at first reproduction	4-5 years
Number of eggs produced	1,300 to 9,000
Maximum size	Greater than 30 pounds and 36 inches
Life span	Up to 10 years
Food habits	Juveniles are insectivorous. Adults are piscivorus
Incubation success (percent)	Water temperature critical: 32-36 °F = 80-95 percent 43 °F = 60-90 percent 46-48 °F = 0-20 percent Sediment size: 20 percent fines = 40 percent 30 percent fines = 20 percent 40 percent fines = 1 percent
Migration strategies	Resident, adfluvial, fluvial, and anadromous
Closely related species	Dolly Varden, lake trout, and brook trout
Optimal and maximum water temperature	Juveniles = 39-48 °F and 59 °F Adults = 39-48 °F and 64 °F
Spawning season	September through November

Bull trout can live up to 10 years and are sexually mature after 4 years. They spawn during September through November, in cold, flowing groundwater-fed streams that are clean and free of sediment. The incubation period for bull trout is extremely long, and young fry may take up to 225 days to emerge from the gravel. Juvenile bull trout mature slowly, often spawning for the first time in their fourth or fifth year.

Migratory bull trout live several years in larger rivers or lakes, where they grow to a much larger size than resident forms before returning to tributaries to spawn. Growth differs little between forms during their first years of life in headwater streams, but diverges as migratory fish move into larger and more productive waters (Rieman and McIntyre, 1993).

It appears that most bull trout, even those not ready to spawn, migrate upstream beginning in May-June and return in November-December. This migration may be in part to avoid high summertime water temperatures in some areas or insufficient flows or water levels. Variation in the timing of outmigration and in the timing and frequency of spawning also represents diversity in life history. Bull trout may spawn each year or in alternate years.

7.4.6.1.4 Habitat Requirements

Bull trout have some of the most demanding habitat requirements of any native trout species mainly because it requires water that is especially cold and clean. Eggs are extremely vulnerable to siltation problems and bed load movement during the long incubation period. Any activity that causes erosion, increased siltation, removal of stream cover, or changes in water flow or temperature affects the number of bull trout that hatch and their ability to survive to maturity (Knowles and Gumtow, 1996).

Water temperature is a critical habitat characteristic for bull trout. Temperatures above 59 °F are thought to limit bull trout distribution (Batt, 1996). Optimum water temperatures for rearing are thought to be 45-46 °F. Researchers recognized water temperature more consistently than any other factor influencing bull trout distribution. However, it is poorly understood whether the influence of temperature is consistent throughout life or whether a particular stage is especially sensitive.

Bull trout have voracious appetites and take full advantage of any and all food sources available to them. Fish are considered to be the major item in the diet of large bull trout. Adult bull trout that are adfluvial generally spend about one half of every year associated with a reservoir (generally November-May). These fish most likely forage in shallow areas where the majority of prey exist. Depending on water conditions, bull trout will occupy deeper areas of the reservoir where water temperatures are cooler (45-54 °F) and move to the surface when surface water temperatures drop to or below 54 °F.

7.4.6.1.5 Factors Contributing to Decline

Bull trout were formerly viewed as a "trash fish" by anglers–they consume juvenile salmon and other game fish so they were considered undesirable predators. In the past, many fish and wildlife agencies mounted active campaigns to eliminate bull trout, but even after these efforts ceased, populations continued to decline due to impacts of other human activities. Impacts on bull trout generally occur from three areas of resource management: (1) land management, (2) water management, and (3) fisheries management. Current recognized threats to bull trout include: habitat degradation, passage barriers and stream diversions, competition with exotic species (especially brook trout), reduced populations from overfishing or eradication efforts, and catastrophic events (fire, timber salvage, drought).

7.4.6.1.6 Baseline Conditions

7.4.6.1.6.1 Boise River Basin--Arrowrock Reservoir and Lucky Peak Lake

Telemetry and recapture studies from 1996-1998 have shown a healthy population of adult bull trout in Arrowrock Reservoir. These adult fish migrate into the upper Boise River tributaries from May to June, and return to Arrowrock from September to October.

It is apparent from these recent studies that bull trout are being entrained from Arrowrock Dam into Lucky Peak Lake where there are no tributaries that appear to be used for spawning by bull trout. It appears that entrainment occurs both during spill events and during operational releases through the dam. Bull trout recaptured in Lucky Peak have been in good condition, showing no abnormal signs from passing over the spillway or through the valves.

It is likely that sub-adult bull trout are present in Arrowrock Reservoir, where they reside until mature. Based on information from other river systems, it is most likely that these fish rear in their natal streams for 2-3 years before migrating downstream to Arrowrock Reservoir and stay there for 2-3 years. These fish subsequently migrated upriver as mature adults. It is speculated that these sub-adults are also vulnerable to entrainment.

7.4.6.1.6.2 Boise River Basin--South Fork Boise River to Anderson Ranch Dam

Electrofishing surveys have documented the presence of bull trout in the South Fork Boise River below Anderson Ranch Dam; although capture numbers have been small. It is not known to what extent these bull trout are adfluvial, migrating up the South Fork from Arrowrock Reservoir; fluvial, residing in the South Fork; or passed through Anderson Ranch Dam. Telemetry data has documented the movement of adult bull trout movement from Arrowrock Reservoir up the South Fork; however, spawning in the South Fork has not been documented. A resident population of bull trout exists in Rattlesnake Creek, tributary to the South Fork. It is not known whether any other bull trout migrate into Rattlesnake Creek to spawn or whether fish from the creek migrate downstream to Arrowrock Reservoir.

7.4.6.1.6.3 Boise River Basin--Anderson Ranch Reservoir

Sampling records for Anderson Ranch Reservoir show that significant numbers of an adfluvial population of bull trout resides for part of the year in the reservoir. A single years data from telemetry studies in 1998 indicate that these fish also migrate upstream to spawning grounds above the reservoir then return in the fall. However, there is no indication to date that there is entrainment of bull trout through the dam.

7.4.6.1.6.4 Payette River Basin–Deadwood Reservoir

There is a small adfluvial bull trout population in Deadwood Reservoir. Due to the small sample size, no conclusions can made at this time on the size, condition, or movement of bull trout in Deadwood Reservoir and its tributaries; although Trail Creek appears to be the main tributary utilized by spawning adults.

Populations of bull trout have been identified during stream surveys in several tributaries of the Deadwood River. Stream reaches having large woody debris and higher numbers of plunge and dam pools tend to have higher bull trout densities These populations are comprised of small bull trout that appear to be resident populations.

7.4.6.1.6.5 Malheur River Basin

An adfluvial population of bull trout has been documented in Beulah Reservoir and the North Fork Malheur River. Resident populations of bull trout also reside in headwater streams in the North Fork Malheur watershed. Telemetry data have shown that adult bull trout migrate from the reservoir to spawn in upper reaches of the North Fork and then return to the reservoir to winter. It is also probable that juvenile bull trout migrate into the reservoir after initial rearing in their natal streams. Anglers have also reported catches of bull trout downstream of Beulah Reservoir which indicates that bull trout are most likely being entrained through Agency Valley Dam.

7.4.6.1.6.6 Grande Ronde River Basin

Small populations of bull trout reside in headwater portions of tributaries and in portions of the lower Grande Ronde Basin.

7.4.6.2 Environmental Consequences

7.4.6.2.1 Boise River Basin

7.4.6.2.1.1 Arrowrock Reservoir and Lucky Peak Lake

Bull trout in Arrowrock Reservoir may be adversely affected by the base case reservoir operations. Early summer drawdowns and the low winter reservoir levels during drought periods or for flood control reduce the productivity of the reservoir discouraging growth and reproduction of aquatic invertebrates and plants. This limits the development of the food base for bull trout. When Arrowrock Reservoir is emptied or drawn down to very low levels, nutrients, food organisms, and fish (including bull trout) pass through Arrowrock Dam into Lucky Peak Lake. All of these cause the loss of a portion of the self-sustaining wild fish resource. If sub-adult trout reside in Arrowrock Reservoir for a 2-3 year period, there is a greater potential for sub-adult entrainment than for the migratory adult population that is absent from the reservoir during spawning periods. Large flood control releases in the winter, such as those made during the 1997 water year, may be a potentially significant factor for bull trout entrainment.

Based on little change to the recommended conservation pool in Arrowrock Reservoir it is likely that the No Flow Augmentation would not be significantly different from the Base Case in terms of providing overwintering habitat or entrainment of bull trout in Arrowrock Reservoir.

In comparison, the 1427i scenario would result in a lower conservation pool more often than in the Base Case scenario, resulting in poorer overwintering habitat for bull trout and possibility of increased entrainment to Lucky Peak Lake. In addition, lower pool levels in Lucky Peak during drought years would adversely affect habitat conditions for bull trout which may be entrained through Arrowrock Dam.

The 1427r scenario would be an improvement to the Base Case condition, and may improve overwintering habitat in the reservoir, but may result in additional spills which could counteract any reduction in entrainment caused by higher reservoir levels.

7.4.6.2.1.2 South Fork Boise River to Anderson Ranch Dam

Effects of Base Case reservoir operations on bull trout in the South Fork Boise River downstream from Anderson Ranch Reservoir are unknown. However, any adverse effects are most likely insignificant.

The slight differences in meeting recommended minium flows in the South Fork for all scenarios is not likely to significantly affect the quality of the habitat for bull trout.

7.4.6.2.1.3 Anderson Ranch Reservoir

The conservation pool at Anderson Ranch would be maintained similar to the Base Case condition for all but the 1427i scenario. Periodically reducing the conservation pool under this scenario may result in reduced habitat quality for overwintering bull trout.

Under all scenarios, releases over the spillway of Anderson Ranch Dam, with the exception of significant flood events, are made at the time that the reservoir is full and adult bull trout are more likely to be located near the upper end of the reservoir or have already started migrating from the reservoir into the South Fork. Spilling water in late spring or early summer is unlikely to cause any significant entrainment of bull trout.

7.4.6.2.2 Payette River Basin

Under all scenarios, operations at Deadwood Reservoir, for the most part, are not likely to significantly affect bull trout which inhabit the reservoir or the river downstream. The conservation pool would be maintained, with the exception of drought years when a portion of the conservation pool may be used to meet flow augmentation requirements. If this were the case, the potential for entrainment may increase at the same time. Flows in the Deadwood River would be similar under all scenarios.

7.4.6.2.3 Malheur River Basin

The Malheur River Basin is not included in this analysis of flow augmentation effect because none of the scenarios would affect the operation of reservoirs in the Malheur River system.

7.4.6.2.4 Grande Ronde River Basin

Increased streamflows resulting from water acquisition may would improve habitat conditions for any bull trout populations that may be present in the lower Grande Ronde basin.

7.6 Cultural Resources

"Cultural resources" is a broad term that includes prehistoric, historic, architectural, and traditional cultural properties. It includes such things as archaeological sites, districts, buildings, structures, and objects; standing historic structures or objects; locations of important historic events; and places or resources that are important to the cultural practices and beliefs of a living community. The National Register lists Traditional Cultural Property that is associated with cultural practices or beliefs of a living community that are rooted in that community's history and are important to maintaining the continued cultural and traditional religious identity of that community. Some archaeological sites qualify as traditional cultural properties. Indian Trust Assets are also included in cultural resources but are discussed separately in the Indian Trust Assets section.

Historic resources associated with westward expansion such as districts, buildings, structures, sites, etc are not expected to be affected differently by any of the flow scenarios. For that reason, the discussion in this section is confined to Native American cultural resources. Cultural and religious resources of significance to maintaining the continuing identity of a community were identified. This discussion is limited to those resources that would be affected by providing water for flow augmentation.

Indian tribes within the basin have a strong desire to protect their ancestors' graves, religious and cultural resource sites, and traditional cultural properties which are currently being used by tribes. Many tribal representatives claim ethnic ties to archaeological sites and graves currently lying beneath reservoir pools. Reclamation has a responsibility for protecting archeological and historical properties with confidentiality and has taken a proactive approach to identify the impacts that Reclamation river/reservoir operations would have on those properties. River and reservoir operations impinge on archaeological sites and traditional cultural properties around reservoirs and along the river channel and associated streams. A fundamental assumption for the future is that operations and actions can be directed to minimize impacts to the significant cultural resources by identifying archaeological sites, traditional cultural properties, and sensitive reaches.

7.6.1 Snake River Basin Upstream of the Hells Canyon Complex

7.6.1.1 Affected Environment

7.6.1.1.1 Prehistory

The Snake River was at the center of prehistoric and historic settlement in southern Wyoming, Idaho, and Oregon. As a crucial water source, a source of power, and the locus of abundant plant and animal resources, the Snake River drew people to its banks and tributaries. Although there are differences in the patterns of settlement and subsistence along the river, there are also striking similarities. The importance of fishing and riparian resources is one characteristic that links the prehistoric inhabitants of these areas. In historic times, the emphasis on ranching and farming and the development of irrigation systems that allowed these industries to expand into arid lands are also similar across the Snake River Plain. Differences in river use, however, are observed from east to west. For example, during the ethnohistoric period, the reliance on bison increased with the acquisition of the horse, whereas in central and southwestern Idaho and southeastern Oregon, fish were more important.

Differences over time in use of the river are reflected in site types and diagnostic artifacts. Paleo-Indian sites throughout the Snake River area are characterized by short-term campsites and large, lanceolate projectile point types such as Clovis and Folsom (Frison, 1991; Butler, 1986; Leonhardy and Rice, 1970). Early Archaic sites also show a resemblance across the region with small, short-term campsites and the introduction of notched projectile points. Later in the Archaic, regional differences are more marked in the artifact assemblage, with the appearance of specific point types such as corner-notched dart points in the upper Snake River (Frison, 1991; McNees et al., 1993), and Humboldt, Elko and Pinto series points in the middle and lower Snake River (Butler, 1986; Meatte, 1990; Leonhardy and Rice, 1970; Hanes ,1988; Oetting, 1994). While Archaic sites in southern Idaho and Oregon may include pithouses (Butler, 1986; Hanes, 1988; Oetting ,1994), upper Snake River Archaic sites are characterized by pit features and rock rings (Frison, 1991; Metcalf, 1987). Other distinctive elements of Archaic material culture may seem to have a limited distribution because of the varied conditions for preservation across the region. For example, Oregon has yielded fiber artifacts such as basketry, while such evidence has rarely been found in other areas. In the Late Period, all areas have ceramics of some sort; small, sometimes notched, projectile points, albeit of different styles; and ground stone. Site types vary within each area depending on site function. Upper Snake River Late Period sites are characterized by reoccupation, seed storage locations, stone circles and rockshelters, whereas middle Snake River sites tend to be small campsites or villages with collecting or foraging locations and lower Snake River sites are similar to the middle Snake River with the addition of large sites near wetlands and other resource locations (Reclamation, 1997d).

The Snake River region was one of increasing complexity in settlement and subsistence procurement through time, beginning with nomadic, big-game hunting as early as 12,000-14,000 years before present (B.P.), continuing with small foraging groups, and adding more sedentary collectors affiliated with Fremont and late Shoshone groups into historic times. Eastern Oregon prehistory, like that of southwestern Idaho, is defined by the overlap of Great Basin and Plateau cultures, and by the anadromous fishery of the lower Snake River basin. The historical development of the area parallels that of the arid lands of southwestern Idaho, as well.

The earliest evidence of human occupation in the region comes from the presence of Clovis fluted points in the eastern Snake River Plain and in buried deposits below Twin Falls. Folsom and Plano points, also a part of the Big Game Hunting Tradition, are abundant and widespread in the upper Snake River region (Butler, 1986). About 11,500 years B.P., the Big Game Hunting Tradition was succeeded by a period in which broad spectrum foragers occupied the region using a small range of tools (including ground stone) to exploit diverse food resources. From approximately 4,200 years B.P. to 250 years B.P., settlement and

subsistence is characterized by semisedentary foraging. During this stage, larger groups occupied riverine villages during the winter months, relying on stored foods collected throughout the remainder of the year. Diverse tool assemblages, semisubterranean dwellings (i.e., pithouses), and greater reliance on salmon represent the indicators of this period. The final period, beginning about 250 years ago, involved intensive use of horses, permitting a dramatic increase in the efficiency and range of resource procurement activities (Meatte, 1989).

A considerable number of pedestrian archaeological surveys have been made throughout the upper and middle Snake River area. Most of the surveys have been in response to various land use projects, such as telephone cables, powerlines, dam construction, timber sales, rights of way, and access. Hundreds of archaeological sites have been reported, and some areas display high site densities (e.g., American Falls, Cascade Reservoir, Owyhee River basin, Malheur River area, and Jackson Lake). However, it is estimated that only 10-20 percent of the land surface adjacent to the upper and middle Snake River has actually been surveyed (for example, six Reclamation project areas have not been surveyed). It is expected that future surveys will encounter the same variety and abundance as found at previously recorded sites. The collection of sites reflects the full range of human occupation in the region, from the Paleo-Indian period through the historic era. A wide range of site types has been identified that appear to represent diverse cultural activities and functions. Site functions represented include: short-term, single-purpose camps such as hunting or fishing camps; resource collecting or processing campsites; substantial base camps, perhaps representing winter encampments of large groups of people; procurement stations not associated with a camp; and features associated with ceremonial activities.

7.6.1.1.2 Native Americans

Prior to European contact, southern Idaho and eastern Oregon were primarily occupied by three linguistically distinct groups: the (Snake River) Shoshone, Northern Paiute, and the Bannock. All three are Numic dialects (Madsen, 1980). The Shoshone and Bannock occupied lands from south of the Salmon River in southeastern Idaho across the Snake River Plain to western Idaho, and the Paiute lived primarily in southwestern Idaho and the western Snake River basin. The Snake River and numerous other drainages were the central locations for the populations (Steward, 1938). Shoshone and Bannock patterns of subsistence were well adapted to the requirements of mobility necessary for exploiting a wide range of resources over large expanses of terrain. Downstream of Shoshone Falls, the Shoshone and Bannock fished along the Snake River for salmon and other anadromous fish using spears, harpoons, traps, dip nets, seines, and weirs (Walker, 1978). After the Shoshone and Bannock acquired the horse in the early 1700s, some groups joined to hunt bison in Wyoming and Montana in late summer (Walker, 1978). Bison were also hunted on the upper Snake River Plain until about 1840, when most of the great herds were gone (Murphy and Murphy, 1960).

The Northern Paiute subsisted on seasonally available salmon, roots, bulbs (such as camas or bitterroot), and on large and small game). A wide variety of small mammals, birds, fish, and insects were eaten as well as various seeds, tuberous roots, and berries. In early May, people left their winter villages to search for edible roots. After the salmon run ended, family units would wander across the land taking deer, sage hens, and other birds, and collecting seeds and roots. In mid-July, women gathered crickets, and in August and September, currants and huckleberries, while the men hunted deer and elk in the mountain areas. Communal rabbit and antelope drives were activities in September, and by November, people were gathering foods from temporary cache pits and returning to their winter quarters. Big game were hunted with bow and arrow, traps, corrals, and dogs. Smaller game was taken with bow and arrow, snares, deadfalls, and in large cooperative drives where they were netted, shot, or clubbed. Fishing was done with dip nets or harpoons, hook and line, weirs, nets, baskets, and traps (Walker and Matthews, 1996).

7.6.1.1.3 Historic Period

The historical development of southern Idaho follows the broad patterns of development of the Northwest in general (Reclamation, 1997d). As such, it is represented by the following historical themes: Exploration and the Fur Industry (1805-1843); The Oregon Trail and Westward Migration (1836-1860); Mining (1860-1880); Farming/Ranching and Economic Development (1840-1940); and World War II and the Pre-Modern Era (1940-1960). The historical development of eastern Oregon roughly parallels that of southern Idaho, as follows: Exploration and Fur Trade (1805-1848); Settlement and Territorial Development (1848-1859); Early Statehood (1859-1904); Federal Reclamation and Irrigation (1904-1920); Interwar Years and the Great Depression (1920-1940); and World War II and the Pre-Modern Era (1940-1960). Artifacts, facilities, structures, and other remnants of the historic past associated with these themes can be found scattered throughout various locations of the upper and lower Snake River.

Early irrigation projects in the southern region were small-scale and were constructed with horse-drawn plows, shovels, and scrapers (Beal and Wells, 1959). The 1880s and 1890s saw an increase in large-scale irrigation canals aided by advances in technology, and by 1900 more than 600,000 acres were under irrigation in southern Idaho (Tucker et al., 1991). The twentieth century saw the involvement of the Federal government under the Reclamation Act of 1902 and the inauguration of major dam and canal projects.

7.6.1.1.4 Traditional Cultural Properties/Sacred Sites

A survey to locate and record properties that are of religious or cultural importance to current tribes has not been undertaken for the Snake River, and probably will not be, due to the sensitivity of such locations. The Shoshone-Bannock Tribes have indicated that there are places along the Snake River that still retain their natural integrity to permit conduct of traditional ceremonial functions (Reclamation, 1994b), and this is undoubtedly the case for the Shoshone-Paiute Tribes. Various natural and physical features on the landscape hold spiritual or religious significance to the aboriginal Snake River tribes. In Northern Shoshone-Bannock religion, spirits are believed to inhabit special places in the landscape, making these locations dangerous and sacred. Ritual precautions, such as bathing or offering gifts, must be performed before going to such places. These sacred places include mountains, foothills, buttes, springs, lakes, rivers, caves, burial places, petroglyph and pictograph sites, and others such as battle or massacre sites (Walker and Matthews, 1996). Human burial sites are expected to occur in talus slopes, the base of canyon walls, and other places. In addition, locations exist along the Snake River that have traditionally served and continue to serve as plant and other resource collection areas, and as such, would constitute places of traditional cultural importance to the Shoshone-Bannock, Shoshone-Paiute, Burns Paiute, and possibly other tribes.

7.6.1.2 Environmental Consequences

7.6.1.2.1 Base Case

Current Reclamation operations are affecting archaeological, historical, and TCP/sacred sites at all reservoirs. Changing water levels and flows cause wave action, innundation, and exposure of reservoir drawdown zones, all of which are adversely affecting cultural resources. Varying water levels or flow velocities associated with reservoir operations are causing erosion of banks around reservoirs (such as at American Falls Reservoir) and possibly along streams below reservoirs. At reservoirs with steep slopes (such as Black Canyon, or parts of Palisades or Anderson Ranch Reservoirs), damage to cultural resource sites would be more restricted than at Cascade, where the rise in elevation is gradual and is spread over a larger horizontal area. Erosion also occurs within a reservoir pool, well below the water surface.

Exposed archaeological deposits in the reservoir's bare littoral (exposed beach) zone are subject to direct mechanical impacts involving physical site damage, artifact movement, soil movement, and the movement of organic deposits such as bone. Because inundation removes vegetation, wind and water erosion deflate archaeological sites in this zone (removing archaeological soils and leaving heavier items and artifacts in place). In certain soils, rapid drawdown causes mass wasting (slumping or landslides) of slopes in or above the reservoir. (At Jackson Lake Dam it was determined that the most critical zone for site preservation is the area subject to shoreline fluctuation of the water level and wet/dry cycling, i.e., just below full reservoir level.) Direct impacts on archaeological deposits that occur underwater include erosion, chemical change, and accelerated decomposition. Horizontal and vertical provenance are adversely affected. Water running over bare slopes also causes erosional rills and gullies. Indirect impacts to archaeological, historical, and TCP/sacred sites result from reservoirs being made more attractive for recreation use, thereby increasing the potential for vandalism and artifact theft. These effects, which are generally unavoidable, occur at all reservoirs in the MAF study area during the annual cycle.

Informal discussions and coordination with tribes in the flow augmentation study area indicate strong interest by the tribes over the protection of their ancestors' graves, religious and cultural resource sites, including traditional cultural properties which are currently being used by tribes. Many tribal representatives claim ethnic ties to archaeological sites and graves currently lying beneath reservoir pools. Tribal representatives have expressed concern over exposure of cultural resource sites at reservoirs, as many of these reservoirs (for example, Unity, Owyhee, and Cascade Reservoirs) are still in active use by tribes as traditional use areas and locations where plants and other resources are collected. Reservoir drawdown operations can dessicate wetland plant populations, restricting their use during the year, and destabilize banks containing traditional use sites.

In the downstream channel, the extent and nature of damage to archaeological sites, historical sites, and TCP/sacred sites from reservoir operations upstream is difficult to determine and to distinguish from damage that would be occurring through natural stream flow. Rapid changes in downstream flows can cause banks to slump; therefore, at the empirical level, we can state that cultural sites situated on such banks would be adversely affected (at least more quickly than if there were not rapid changes in flows). However, without monitoring such effects to particular sites over a period of several years and correlating the changes in site integrity to particular reservoir operations upstream, generalized cause and effect statements are untenable. Although adverse changes to archaeological, historical, and TCP/sacred properties are probably occurring, the cause and nature of those changes remain to be verified and quantified.

Erosive forces acting on archaeological, historical, and TCP/sacred sites are accretional and cumulative from one annual operational cycle of the reservoir to the next. The impacts are not one time events, but coincide with the annual cycle of reservoir operations. Hence, each year, a given cultural resource property that is being affected by reservoir operations, is potentially worse off than the previous year. If the elements that contribute to a site's eligibility for the National Register are compromised, there reaches a point where the integrity of the site is so diminished that the site loses its potential eligibility.

The adverse effects occurring to archaeological, historic, and TCP/sacred sites as a result of Reclamation's and other agencies' reservoir operations are irreversible and irretrievable. Adverse effects to archaeological and historical properties that are of National Register quality can be mitigated through data recovery procedures, recordation, and other mitigation strategies. However, an archaeological or historical site is a unique creation from the past. It cannot be regenerated or regrown, even like an endangered plant can. Once the site or a portion of it is destroyed, it is essentially destroyed forever, and the damage is irreversible. For TCPs/sacred sites, adverse effects are even more troublesome, since

disturbances to places such as tribal religious locations or resource collecting sites cannot be effectively mitigated in the sense that an archaeological site can.

7.6.1.2.2 No Augmentation

The No Augmentation scenario represents the historic operation before 1992. Reservoir levels and riverflows changes from historic levels to the Base Case are minuscule. Thus any change back to the No Augmentation scenario would have no effects, direct or indirect, to archaeological, historical, or TCP/sacred sites compared to the Base Case. There would be no irretrievable or irreversible commitments of resources above and beyond those identified under the Base Case.

7.6.1.2.3 1427i

Under this scenario, reservoirs would be drawn down more often. Effects to cultural resource sites under this scenario would be more severe than under the Base Case, although the effects are more of degree rather than kind. Water levels in some reservoirs would fall below existing pools and the reservoirs would be dry more often. The lowering of reservoir levels below existing pools would generally adversely affect archaeological resources by cutting new shoreline benches and exposing more land within the reservoir pools to wind erosion, sheetwash, and gullying. This would increase impacts to cultural properties not located on a stable shoreline in the past. In addition, new areas, previously protected by the reservoir pool, would be exposed to artifact collecting and vandalism. While some drawdown zone archaeological sites might be covered by siltation and are protected from erosion and vandalism, others would not be. If the drawdown is rapid (for example, more than 2 feet per day), then mass wasting (slumping or landslides) of slopes in and above the reservoir can be expected, burying or completely destroying archaeological sites. Historic above-the-ground sites or structures probably would not be affected by increased drawdown levels unless the levels resulted in a change in the integrity of "feeling" or "association" of a historic property, for example, lowering the pool to a level that compromises the visual integrity of the reservoir by introducing an element that is inconsistent with its historic character.

Greater drawdown and longer drawdown periods would negatively affect TCPs/sacred sites by desiccating wetland plant populations for longer periods, thereby reducing the availability of these resources during the year (although access to these areas would probably be improved). In addition, severe drawdown would result in bank destabilization of traditional use sites. While significant lowering of reservoir water levels might diminish reservoir use by recreationists, movement of their activities to other areas could affect TCPs/sacred sites in those areas. Some archaeological sites also qualify as TCPs; therefore, the damage potential to archaeological sites described in the previous paragraph, would also apply to TCPs that are archaeological sites.
Greater drawdowns would result in increased flow velocities and water levels along downstream banks (although not exceeding levels achieved during past spring runoff and flooding). Rapid changes in downstream flows can cause stream bank slumping by alternately saturating soils and then exposing them to air and stream currents. The resulting increased bank erosion could disturb or completely destroy blocks of ground in which archaeological sites are bedded, or in which historic sites or TCPs/sacred sites are located, or the place that is the setting or contextual landscape for such resource sites. Increased flow velocities and water levels could reduce use of riparian habitat and availability of plant species in traditional plant gathering areas. At the same time, access to these areas might be rendered more difficult. Other resources of traditional cultural or religious interest to tribes (such as sacred places used to communicate with spirits or make medicine, or established tribal fishing locations) could be diminished in size or completely covered with water during certain times of the year. The extent to which heavy drawdown would cause an increase in these adverse conditions above and beyond what would naturally occur, or what would occur through normal reservoir operations, is problematic. Theoretically, adverse

effects from the drawdown would occur to cultural resources in the stream channel; however, our position is that such effects attributed to the drawdown cannot be determined, and if they could, would be negligible. Recreation potential would, however, likely decrease under greater flow velocities and water elevation, thus reducing indirect impacts to archaeological sites associated with artifact collecting and general disturbances from increased human traffic in an area.

Erosive action on archaeological, historical, and TCPs/sacred sites would be cumulative from year to year, from one annual operational cycle of the reservoir to the next. The impacts would not be one-time events, but would coincide with the annual drawdown, and would be of greater intensity than under the Base Case. Elements of a cultural resource property that contributed to that property's eligibility to the National Register, would be compromised annually, diminishing and eventually eliminating the site's ability to qualify for the Register.

Adverse effects to archaeological, historic, and TCP/sacred sites would be irreversible and irretrievable, and more severe than under the Base Case. Adverse effects to archaeological and historical properties that are of National Register quality could be mitigated through data recovery, recordation, and other mitigation strategies. However, once an archaeological or historical property or portions thereof are destroyed, the destruction is permanent, and the damage is irreversible. For TCPs/sacred sites, adverse effects would be more difficult to deal with, since disturbances to religious locations or plant gathering areas could not be effectively mitigated in the sense that an archaeological site can be. The loss to the original religious location or resource collection areas could not be mitigated or restored.

7.6.1.2.4 1427r

Under the 1427r scenario, reservoir water levels would not be affected beyond the normal annual cyclical fluctuations of the Base Case. Releasing water downstream for flow augmentation instead of diversion to irrigated lands would raise riverflow velocities and water levels to some extent. Rapid increases in flow and water levels can cause stream bank slumping with concomitant adverse effects on archaeological sites, historical sites, and traditional cultural properties/sacred sites. However, these increases would not exceed the year-to-year seasonal changes in hydrology due to variations in runoff. While it is possible that increased water flow and elevation resulting from reducing diversions could adversely affect cultural resource sites in the stream channel, it is not clear to what extent such effects would occur. Any correlation to the 1427r Scenario would be negligible.

If the land surface involved in 1427r remains with the private landowner, it would probably be converted to crested wheat grass. If the land surface is acquired by the Federal Government, it would probably be revegetated with native species. In either case, the destructive chemical and physical effects of water on archeological sites and materials from the annual irrigation cycle would be reduced. Thus, effects on previously irrigated lands would be positive for archaeological site preservation. For above-the-ground historic buildings and structures, major vegetation changes could alter the integrity of historic properties by introducing a visual element (e.g., native plant species) that is inconsistent with its historic character.

Increased riverflow velocities and water levels would occur along the downstream channel, and, although not at unprecedented levels, could, theoretically, physically impact properties of religious or cultural value situated adjacent to the stream channel. Traditional plant gathering areas or other areas of traditional cultural or religious interest could potentially diminish in size or be otherwise compromised. Access to these places might become more restricted. Adverse effects to TCPs or sacred sites, if they could be correlated to the 1427r scenario, would be negligible.

7.6.2 Salmon River Basin

7.6.2.1 Affect Environment

7.6.2.1.1 Prehistory

Indians have occupied the mountains of central Idaho for at least 10,000 years. The earliest inhabitants had an economic base centered on large mammals, molluscs, and plant resources, with settlements associated with a riverine environment. Between 8,000 and 5,000 years ago the climate was drier and warmer than present. Dependence on game, plant resources, and fishing continued, and settlement pattern is reflected in small camps found along the rivers and mountains. A hallmark of this period is the lanceolate Cascade projectile point. Between 5,000 and 2,500 years ago, the climate became cooler and moister. Permanent pit-house villages with semi-subterranean houses are first noted during this time, along with an increased use of root crops and river clams (possibly reflecting a diminishing salmon population). From 2,500 years ago to about A.D. 1750, the region was characterized by a heavy dependence upon salmon and root crops and occupation of permanent winter villages. The period coincided with the transition from atlatl (spear thrower) use to the use of bows and arrows. The last 250 years has been a time when the horse was introduced and when Indians were relegated to reservations (Leonhardy and Rice,1970).

Numerous archaeological investigations have occurred in the Salmon River Basin, revealing a rich array of sites and site types. On the Lower Salmon, which has a long history of surveys, approximately 200 sites have been recorded, consisting of lithic scatters, house features, burials, rock-rimmed depressions, talus pits, rock shelters, shell and bone middens, and pictographs. At least 300 sites have been documented between the North Fork and South Fork, indicating a prevalence of small corner-notched points on the surface of sites along the Middle Salmon River. Project specific surveys by the U.S. Forest Service have recorded sites along Panther Creek and the North Fork Salmon River. The mouth of the South Fork Salmon River has been identified as a major locus of housepit settlements (over 1,100 house features at several sites in this vicinity). The Upper South Fork, adjacent to Warm Lake, has yielded obsidian and basalt flakes, probably used for fishing tools. Sites on the Upper South Fork suggest a recurring pattern of seasonal use by aboriginal occupants, probably associated with fishing and hunting. House depressions, some with associated surface artifacts (such as small side-notched points), are common along the Middle Fork (Hackenberger and Meatte, 1995).

There appears to be an increase in site density as one approaches the Upper Salmon River and Snake River Plain. Quite possibly, the combined area of the Upper Salmon and the Big Lost River was a principal winter occupation area and pathway between the Salmon and Snake Rivers, and the valleys to the east were used for spring and fall hunting and gathering base camps. Site densities have been reported as one per half mile on the Upper Salmon, one per mile on the Pahsimeroi and Big Lost River, one every five miles on the Little Lost River, and one every eight miles on Birch Creek (Hackenberger and Meatte, 1995).

Water resources are an important consideration in location of most site types. For example, the Nez Perce only located permanent settlements along rivers, and Shoshone villages were also associated with water. Rockshelters and pictographs are associated with steep slopes near water. In addition, slope is an important aspect for determining where sites might be present. Lithic scatters are found on 15-30 degree slopes, in a relatively flat terrain (Matz, 1994).

Very little information exists for the prehistory of the Lemhi River basin in the far west of the Salmon River Basin. What does exist is primarily based on the site inventories conducted by Swanson, King and Chatters for the Bureau of Land Management in 1966 (Swanson et al., 1969). The Lemhi River Valley has been occupied for at least 10,000 years. It appears to have served as one of several travel corridors for millennia, linking the Upper Salmon River country of East-Central Idaho with the Eastern Snake River Plain to the south. It also afforded passage over several mountain passes across the Continental Divide onto the northwest Plains (Wright, 1998).

Sites reported along the Lemhi River Basin include rockshelters and caves, open camps without features, springs, and quarries. Site densities in the Basin were reported to be about one site every two miles. It is suspected that the Upper Salmon, the Pahsimeroi, and the Big Lost River zones were more intensively occupied by larger groups of people for longer intervals of time than were sites in the more easterly valleys. The suggestion is that those three western valleys may have been more heavily used in the winter while the more eastern valleys (such as Lemhi Valley) were used for spring and autumn hunting and gathering and for small group activity (Swanson et al., 1969).

7.6.2.1.2 Native Americans

The Salmon River basin was the aboriginal territory of the Nez Perce, Shoshone, Bannock, and Northern Paiute Tribes. The Indians of central Idaho, regardless of their linguistic or cultural affiliation, relied on hunting, gathering, and fishing for their subsistence. Winter villages, often occupied until early summer, were located in major river valleys, such as the Middle Fork of the Salmon River and Big Creek. Villages consisted of 2-40 extended families. The location of these villages corresponded with the winter range of big game animals and also with desirable fishing spots on the river that insured easy access to early summer anadromous fish runs. Winter villages were probably deserted in late spring or early summer for fields of camas, other important vegetable foods, and big game summer ranges at higher elevations. Summer camps were probably much smaller than winter villages, one band separating into groups composed of a few families in order to facilitate mobile hunting and gathering. The horse was responsible for major changes in subsistence activities of both Shoshone and Nez Perce Tribes. It enabled them to participate in buffalo hunts in western Montana and Wyoming (Rossillon, 1980).

Until around the 19th century, these groups existed as hunter-gatherers subsisting on locally available resources, and through trade were in contact with a much larger world. By the 19th century, and possibly earlier, significant change in their socioeconomic system had begun with contact by Euroamericans (Cannon et al., 1996).

7.6.2.1.3 History

Basic historic themes for the Salmon River basin are exploration, the fur industry, mining, ranching and farming, and recreation. Most of the early expeditions by Euroamericans into the mountains of central Idaho related to the fur trapping business. The Lewis and Clark expedition (1804-06) visited Lemhi Pass, the mouth of Twin Creek, the Continental Divide, the Salmon River, and Lost Trail Pass. Fur trapping was booming by the 1820s and 1830s, but by the 1840s, beaver had been trapped to near extinction. Hardrock and placer mining began by 1866 in what is now the Salmon National Forest. Almost every major stream was placer mined but hardrock mining was confined to specific mining districts. Ranching and farming by immigrants of northern European descent began in this area as early as the 1860's following the discovery of gold. The majority of these people subsisted on imported livestock and agriculture. In the late 1800s and early 1900s, communities such as Lemhi and Baker were established to serve a growing population. Before the economic depression of the 1930s the region had supported a mix of cattle and sheep ranches; however, the increasing cost of grazing permits coupled with range depletion made sheep raising unprofitable. Sheep were exchanged for cattle, and today cattle ranching and hay

farming comprise the major economic activities in the region (Cannon et al., 1996). More recently, the Salmon River basin has become important for its various recreational opportunities available to the public, such as boating, fishing, hiking, and camping (Rossillon, 1980; Matz, 1994).

7.6.2.1.4 Traditional Cultural Properties/Sacred Sites

A diverse array of cultural resources exists within ceded areas. These resources include prehistoric Nez Perce resource procurement sites, hunting and gathering encampments, fishing stations, villages, open camp sites, battlefields, petroglyph and pictograph sites, historic mining sites, prehistoric trails and traveling routes. It is very likely that many of these sites are places of religious or cultural importance to the Nez Perce. In addition, the natural environment of the Nez Perce region provided a variety of resources, most of which were exploited to varying degrees (for example, 71 species of plants). It is probable that areas harboring such resources were used over a period of time by tribal members and would have served as traditional gathering areas. (Also see also discussion under Snake River Upstream of Hells Canyon Complex)

7.6.2.2 Environmental Consequences

Neither the Base Case nor the No Augmentation scenarios affect the Salmon River basin. The effects of the 1427i and the 1427r scenarios in the Salmon River basin are limited to elimination of irrigation of about 87,470 acres with retention of the water in the stream. Any effect that this would have on cultural resources would be minuscule.

7.6.3 Hells Canyon Complex

7.6.3.1 Affected Environment

7.6.3.1.1 Prehistory

The Hells Canyon Complex area of the lower Snake River, between its confluences with the Powder and Salmon Rivers, has been the focus of extensive human activity beginning over 7,000 years ago, and extending through historic times when it became the interest of early explorers, miners, and stockmen. The fertile bars and alluvial terraces within the canyon provided the living spaces for prehistoric and historic peoples. Subject to virtually no recent development, Hells Canyon today contains a unique array of prehistoric and historic sites, many of which have been affected only by the passage of time and natural forces due to the ruggedness and isolation of the canyon.

The Hells Canyon Archaeological District extends approximately 70 miles along both sides of the Snake River from Hells Canyon Dam to ½ mile south of the Cougar Rapids or about 4 miles south of China Gardens. These boundaries were chosen for the National Register nomination because of the intensive archaeological surveys that have been conducted in this area since the 1950's. In conjunction with the National Register nomination, 384 prehistoric archaeological sites (151 rockshelters and 233 open sites) have been reported in the archaeological district. Two thirds of the rockshelters display pictographs or red pigment stains, while over half had lithic remains on the surface. Features such as rock walls, rock alignments, rock and earth berms, and depressions were noted at 37 rockshelters. About 550 housepit depressions have been recorded for the National Register district, with an average density of about five structures per linear kilometer of river (Reid and Gallison, 1995).

At the Bernard Creek Rockshelter (about 10 miles downstream from Hells Canyon Dam), clear evidence of lanceolate projectile points was observed at the lowest levels of the site (about 7,250 B.P.), being replaced by large side-notched points about 6,700 B.P., and subsequently by a miscellany of stemmed, notched, and corner-notched points. Riverine foods were eaten in Hells Canyon by about 7,200 B.P., based on the Bernard Creek Rockshelter, and include varying frequencies through time of birds bones, fish remains, mammal remains, and mussel shell.

A fairly high density of sites has been reported for the Pittsburgh Landing area during the Corps of Engineers and Bureau of Reclamation River Basin Surveys including 39 sites (23 open camps, 2 rockshelters, 9 housepit clusters, 5 burial sites, 1 petroglyph site, and 4 cutbank exposures of buried features and midden lenses in side canyons). One of the cutbank exposures was a cache of 37 flaked basalt bifaces.

The Wallowa-Whitman National Forest sponsored excavations by Idaho State University at Hells Canyon Creek Village in the Inner Gorge in 1967. The Forest Service, in recent years, has conducted inventories of rock art and other sites. In 1989, housepit clusters and an open camp site and shell midden were investigated for Section 106 compliance actions in the Lower Canyon area.

The Forest Service has documented 177 rock art sites between Hells Canyon Dam and River Mile 176, about 71 miles downstream. The sites tend to occur more frequently on the east (Idaho) side of the Snake River, and greatest concentrations are in the southern (upstream) area, in the Inner Gorge locality between Hells Canyon Creek and Sheep Creek (Reid and Gallison, 1995).

7.6.3.1.2 Native Americans

(See previous discussion under Snake River Basin Upstream of Hells Canyon and Salmon River Basin).

7.6.3.1.3 History

There are 152 recorded historic sites in the National Register district, most representing several of the major themes for the region: mining and ranching/farming (including irrigation). Placer mines and hardrock mines were established in the Hells Canyon area, as evidenced by piles of waterworn cobbles, placer tailings, structures such as cabin ruins or foundations of walls, and mining equipment. Homesteads associated with agriculture and sheep ranching comprise most of the remaining historic sites. Some include intact dwellings, barns, sheds, and root cellars, and irrigation canals. Also present in the district are a number of cemeteries, roads, and trails. There is also an historic petroglyph, a unique irrigation flume, and a vertical test shaft for a dam proposed in the 1950's but never built (Hells Canyon NRHP Nomination).

7.6.3.1.4 Traditional Cultural Properties/Sacred Sites

(See previous discussion under Snake River Basin Upstream of Hells Canyon and Salmon River Basin).

7.6.3.2 Environmental Consequences

The effects of the Base Case and No Flow Augmentation scenarios would be indistinguishable. The results of both are to moderate flows in this reach of the Snake River. Implementation of the 1427i and 1427r scenarios would be identical in this river reach, increasing the annual flow volume and the average flow during the flow augmentation period. The significance of this flow increase would be difficult to determine or correlate with any possible adverse or beneficial effect on cultural resources or Traditional Cultural Properties.

7.6.4 Snake River to Lower Granite Dam

7.6.4.1 Affected Environment

7.6.4.1.1 Prehistory

Prehistory of the area is similar to elsewhere in the western United States and is conveniently discussed in terms of phases. The earliest (Windust) phase (10,000-8,000 B.P.) is represented by broad spectrum foragers who dispersed throughout most topographic zones and displayed a well-developed tool technology. The economic cycle centered on large mammals, molluscs, and plant resources. Apparently there were no permanent winter villages or groupings of people and settlements are associated with a riverine environment. The subsequent Cascade Phase (8,000-4,500 B.P.) represents a shift towards greater use of plant foods and aquatic resources including freshwater clams and salmon. The artifact assemblage is typified by the lanceolate Cascade projectile point and later by introduction of side-notched points. The Tucannon Phase (4,500-2,500 B.P.) reflects an aggregation of population into pit house villages and increased use of root crops and river clams. The Harder Phase (2,500-250 years B.P.) Represents expansion of pit house village sites, procurement of salmon and roots, and coincides with the transition from atlatl (spear thrower) use to bows and arrows (Sappington, 1995).

The area along the lower Snake River between Hells Canyon Dam and Lower Granite Dam contains an abundance of archaeological sites which, collectively, represent the major phases discussed in the previous paragraph. At Lower Granite Lake, 136 prehistoric and historic period sites range in age from the earliest period of human occupation to recent times. Large alluvial bars were major occupation surfaces prehistorically; 13 archaeological sites were recorded at river bars downstream of Clarkson before Lower Granite Lake was filled. Along this stretch of the lower Snake River, data recovery excavations have been made at the Wawawai site at Wawawai Canyon, the Wexpusmime site at Offield Canyon, the Granite Point site below Wawawai Canyon, and the Alpowa Locality below Clarkston. Findings include lanceolate and corner notched dart points, semisubterranean house pits, mortars and pestles, shell beads indicating trade from the Pacific coast, and remains of small mammals, fish, and shellfish.

Upstream of Lewiston, in the Asotin district, a “Snake River Archaeological District” and a “Nez Perce Snake River Archaeological District” have been nominated to the National Register of Historic Places. The districts include 97 seasonal campsites, 27 housepit sites, 44 burial sites, 23 storage shelters, and 17 additional sites which contained features such as pictographs, petroglyphs, fish walls, storage pits, and sweat lodges. About two thirds of the sites could be grouped into 11 separate site complexes or clusters on either side of the Snake River. Site density seems to fall off abruptly above the Grande Ronde on both sides of the river, possibly due to increasingly rugged topography.

A Native American cemetery is known to exist in the town of Asotin. The cemetery appears to represent the late prehistoric, protohistoric, and historic periods. Some of the burials contain varied grave goods and were interred in cedar cists marked by rock cairns.

Other significant sites include the Red Elk Rockshelter 10 km upstream of Lewiston; the Hasotino house pit village, now part of Hell’s Gate State Park and on the National Register; Buffalo Eddy rock art (including 885 glyphs) near River Mile 160 on the Washington side; and the Scorpion Knoll multicomponent site near Captain John’s Creek (Reid and Gallison, 1995).

7.6.4.1.2 Native Americans

This area is within the traditional territory of the Nez Perce Indians. The Nez Perce used lower canyons for winter settlement, fishing, and fall and winter hunting. Upland areas were used from late spring to fall for plant gathering, travel, and hunting The Nez Perce traditionally obtained about 50 percent of their diet from anadromous and other fish, most importantly the salmonids and steelhead trout. Game formed only 15-25 percent of their diet. At least 36 different edible plants were used, most important being roots such as camas or kouse. During late fall and winter months, the Nez Perce were located in fairly large villages along the Snake, Clearwater, and Salmon Rivers. Families generally returned to the same location each year. In spring, the bands and families dispersed to their favorite fishing stations along the rivers. Summer was a time of intense subsistence activities and intergroup contact, followed by fall fishing and hunting (deer were the most important food animal), although hunting continued year-round. The horse was adopted by the Nez Perce by the mid-1700's and provided ready access to the bison-hunting grounds on the Plains (Sappington, 1995).

7.6.4.1.3 History

Historic themes for the lower Snake River to Lower Granite Lake generally follow the thematic events common to the Columbia River Basin. The historic period began with the arrival of the Lewis and Clark expedition in 1805. This was followed by other expeditions, which further explored the region and established trading operations. Missionaries arrived in the 1830s, followed in the 1840s by settlers coming west. Gold was discovered in Idaho in the 1860s, leading to an influx of people into the area, and further settlement based on extensive dryland wheat farming. The 1880s brought construction of railroads and continued settlement. The 1900s has witnessed the damming of the Snake River, the development of major irrigation projects, and continued growth in the region (Corps and NMFS, 1994). Sites, structures, and facilities associated with these events can be expected to be found along this segment of the lower Snake River.

7.6.4.1.4 Traditional Cultural Properties/Sacred Sites

A diverse array of cultural resources exists within Nez Perce ceded areas. These resources include prehistoric Nez Perce resource procurement sites, hunting and gathering encampments, fishing stations, villages, open camp sites, battlefields, petroglyph and pictograph sites, historic mining sites, prehistoric trails and traveling routes. It is very likely that many of these sites are places of religious or cultural importance to the Nez Perce. In addition, the natural environment of the Nez Perce region provided a variety of resources, most of which were exploited to varying degrees (for example, 71 species of plants). It is probable that areas harboring such resources were used over a period of time by tribal members and would have served as traditional gathering areas.

7.6.4.2 Environmental Consequences

The effects of the Base Case and No Flow Augmentation scenarios would be indistinguishable. The results of both are to moderate flows in this reach of the Snake River. Implementation of the 1427i and 1427r scenarios would be identical in this river reach, increasing the annual flow volume and the average flow during the flow augmentation period. The significance of this flow increase would be difficult to determine or correlate with any possible adverse or beneficial effect on cultural resources or Traditional Cultural Properties.

7.6.5 Grande Ronde River Basin

7.6.5.1 Affected Environment

7.6.5.1.1 Prehistory

The Grande Ronde River basin has been occupied for millennia. By 7,000 B.P., technology reflected by stone tool manufacture was well-developed. Until the last 4,000 to 5,000 years, artifact technology was relatively stable, especially for projectile points. During the earlier period (approximately 8,000 to 4,000 B.P., the only major change in projectile points was from a bipointed lanceolate form to a triangular form. After 4,000 B.P., projectile point types and sizes became more variable (Hudson et al., 1978).

Professional archaeological investigations have been conducted in the Grande Ronde Valley since 1967. On Old Channel, an abandoned meander of the Grande Ronde, 27 prehistoric sites were located. Except for one rockshelter, all were "open sites" or "open campsites with burials." Fire cracked rock observed at some of the sites quite possibly mark prehistoric camas steaming pits (early settlers saw Nez Perce come to this valley to harvest camas). Three sites have been excavated in the Ladd Canyon area (Stockhoff Basalt Quarry, Marshmeadow, and Ladd Canyon). The Stockhoff Quarry, southeast of LaGrande, is a basalt resource site and lithic reduction station. The site contains lithic materials in various stages of manufacture, from raw material to finished artifacts. A variety of lanceolate and side notched points, various tools used in artifact production, and other artifacts were recovered, dating from 10,000 to 6,000 B.P. Unglazed pottery has also been reported along the Grande Ronde Basin (Hudson et al., 1978; Reid and Gallison, 1995).

Considerable variation is observed in the use of geographic locations for habitation and resource procurement areas. At higher elevations, open campsites, quarry sites, lithic reduction sites, and rockshelters are found. At lower elevations, complex village sites, open campsites, fishing stations, and numerous rockshelters have been located. Site density is lower at higher elevations and higher in the lower elevations (Hudson et al., 1978).

7.6.5.1.2 Native Americans

Aboriginal ethnographic boundaries in the Grande Ronde Basin area are not well-defined. The basin does, however, appear to fall within the area jointly exploited by the Cayuse, Umatilla, Nez Perce, Northern Paiute, Shoshone, and sometimes the Walla Walla Indians. The Cayuse, Umatilla, and Nez Perce settlements generally followed a linear pattern with winter villages located along banks of major rivers and their larger tributary streams. Associated dwellings were the long communal house, circular tipi lodge, semi-subterranean menstrual lodge, and sweat lodge. During spring, summer, and fall months, when portions of the village populations were involved in hunting, fishing, and gathering activities, similar dwellings were used. Among the Northern Paiute the settlement pattern was very similar. Principal food resources for the Cayuse, Nez Perce, Umatilla, and Northern Paiute were plant items and fish, supplemented with meat, berries, and roots. The annual seasonal round of food gathering activities for each ethnic group varied depending upon its geographic location. Trade relations among the Nez Perce, Walla Walla, Umatilla, Cayuse, and Northern Paiute were well established at the time of historic contact. The Grande Ronde Valley and Wallowa Lake were favorite areas for the annual social and trading event (Hudson et al., 1978).

7.6.5.1.3 History

Northeastern Oregon history includes themes which are similar to those in the Northwest in general, and includes exploration and the fur industry, military, overland migration, mining, ranching/farming, and transportation and communication. From the time of Lewis and Clark's expedition (1804-1806) until the discovery of gold (1860), this area usually was passed through or visited only briefly by explorers, traders, trappers, missionaries, and settlers. By the 1830s, the fur trapping/trading business had begun to wane. During the mid-1800s, forts were established as a response to Indian-White conflicts and as a means for protecting immigrants and settlers. By the 1840s, travel along the Oregon Trail (which passed through the Grande Ronde Valley) was increasing for immigrants destined for the Willamette Valley and Pacific coast. The earliest settlements developed at mining areas in the late 1850s and early 1860s, and the discovery of gold was the major stimulus for settlement in northeastern Oregon. The area grew rapidly and, as new finds were made, towns were created and markets were established for merchants and farmers. The Grande Ronde Valley and Powder River Valley became farming districts in the 1860s, and cattle and sheep raising grew throughout the 1860s, 1870s, and 1880s. The completion of the Northern Pacific Railroad in 1883 enabled timber to be shipped to other parts of the United States, and logging railroads began to develop in the area up to the 1930s. Major cutting operations continue to the present with new machinery and techniques (Hudson et al., 1978).

7.6.5.1.4 Traditional Cultural Properties/Sacred Sites

As with many Northwest tribes, religious practices were commonly related to natural phenomena (such as animals, plants, and geographic features), and it is likely that a variety of sacred places are associated with these natural phenomena. It is suspected that for tribes of the Grande Ronde and Powder River areas, many locations of cultural and religious importance are tied to the land and still retain sufficient integrity for traditional ceremonies to occur. The same would hold true for traditional plant and resource gathering areas. (Also see discussions under Snake River Upstream of Hells Canyon Dam and Salmon River Basin)

7.6.5.2 Environmental Consequences

Neither the Base Case nor the No Augmentation scenarios affect the Grande Ronde River basin. The effects of the 1427i and the 1427r scenarios in the Grande Ronde River basin are limited to elimination of irrigation on about 37,000 acres with retention of the water in the stream. Any effect that this would have on cultural resources, whether negative or positive would be minuscule.

7.7 Indian Trust Assets

The United States, with the Secretary of the Interior as the trustee, holds many assets in trust for Indian tribes and individuals and has a responsibility to protect and maintain rights reserved or granted by treaties, statutes, and executive orders. These rights are sometimes further interpreted through court decisions and regulations. This trust responsibility requires that all Federal agencies, including Reclamation, take all actions reasonably necessary to protect trust assets.

The Department of the Interior defines ITA's as legal interests in property held in trust by the United States for Indian tribes or individuals. Examples of trust assets are lands, minerals, hunting and fishing rights, and water rights. Reclamation has a responsibility for protecting archeological and historical properties and ITA's. Reclamation operations can affect ITA's in river corridors and reservoirs. Effects can extend beyond the river corridor to Federal lands where some tribes hold off-reservation treaty rights.

Reclamation has a responsibility to manage sensitive information with confidentiality. Much of the data is highly sensitive because of its religious or spiritual nature, and there is a concern that it could get into the hands of people whose motives are in direct conflict with the interests and beliefs of the tribes.

The Snake River basin upstream of Lower Granite Lake includes aboriginal areas of the following:

- Nez Perce Tribe (the Nez Perce Indian Reservation is in the Clearwater drainage which is not included in this analysis).
- Confederated Tribes of the Umatilla Reservation of Oregon (the Umatilla Indian Reservation is in the Umatilla River Drainage which is not included in this analysis).
- Shoshone-Bannock Tribes of the Fort Hall Indian Reservation in eastern Idaho.
- Northwestern Band of the Shoshone Indians of Utah (there is no reservation to be included).
- Shoshone-Paiute Tribes of the Duck Valley Indian Reservation in southern Idaho and northern Nevada.
- Burns-Paiute Tribes (the Burns-Paiute Indian Reservation near Burns, Oregon is not in the Snake River drainage and not included in this analysis)

ITAs with respect to salmon and steelhead fishing are not addressed in this section. Identifying these effects is within the domain of the overall Corps study and will be addressed by the Corps.

7.7.1 Snake River Basin Above Milner Dam

7.7.1.1 Affected Environment

Shoshone-Bannock Tribes located in southeastern Idaho have trust assets both on and off reservation. The northern boundary of the Fort Hall Indian Reservation is the Snake River, and a portion of the reservation is inundated by American Falls Reservoir. The Tribe's ceded lands in the Snake River basin include the area from the Henrys Fork and Jackson Lake to American Falls Reservoir. The Shoshone-Bannock Tribes through the 1868 Fort Bridger Treaty have the right to hunt and fish on any unoccupied Federal lands.

The Northwestern Band of the Shoshone Indians of Utah (Washakie) are a recognized tribal entity, but do not have a reservation. The Northwestern Band possess treaty-protected hunting and fishing which may be exercised on unoccupied Federal lands within the area pursuant to the 1868 Fort Bridger Treaty.

The alteration and decline of the historic aquatic resources has resulted in social, environmental, and economic losses to Native Americans. Native Americans traditionally relied heavily on the once abundant fish of the Snake River as a key component of their diet and way of life. Reservoir operations now impinge on archaeological sites, traditional cultural properties, and other Indian Trust Assets.

7.7.1.2 Environmental Consequences

It is not anticipated that any of the scenarios would have an effect on Indian owned lands or Indian water rights and that any effect on ITAs would be limited to ceded lands and related fishing, hunting, and related rights.

Riverflows and reservoir levels under the No Augmentation scenario are not sufficiently different from that of the Base Case to have an effect on ITAs.

Effects of the 1427i and 1427r scenarios on fish, wildlife, and vegetation, which may be considered part of the ITAs, are discussed in other sections. Effects on these, vary by location and season with some effects positive and others negative. Overall, the effects are expected to about balance, that is, there would be no net positive or negative effect specifically to ITAs in those classes. At this level of analysis, impacts to ITAs are difficult to measure. If flow augmentation in the magnitude of the 1427i or 1427r scenarios is carried forward, specific effects would need to be carefully and clearly identified.

7.7.2 Owyhee River Basin

7.7.2.1 Affected Environment

The Shoshone-Paiute Tribes of the Duck Valley Indian Reservation have trust assets that include reservation lands, water rights, and hunting rights. The reservation lies on the Idaho-Nevada border and was provided for by a treaty of October 1, 1863, established by Executive Order April 16, 1877. The reservation was later enlarged by the Executive Order of March 4, 1886, and the Executive Order of July 1, 1910.

7.7.2.2 Environmental Consequences

Indian land ownership and water rights would not be affected. It is anticipated that none of the scenarios would have an effect on ITAs in this area.

7.7.3 Payette River Basin

7.7.3.1 Affected Environment

The Nez Perce Tribe of the Nez Perce Reservation near Lewiston, Idaho has ceded lands that include the northern portion of Cascade Reservoir (1855 treaty). The tribe's off-reservation reserved rights include fishing, hunting, grazing, and gathering.

The Treaty of 1855 with the Nez Perce Tribe and the U.S. Government resulted in a reservation that included the entire Clearwater River basin as well as large areas in other basins. The treaty provides "The exclusive right of taking fish in all the streams where running through or bordering said reservation is further secured…as also the right of taking fish at all usual and accustomed places in common with citizens of the Territory…" In a subsequent 1863 treaty, the Nez Perce ceded the majority of these lands with the establishment of the present reservation, but reserved off-reservation fishing, hunting, grazing and gathering rights. Further court interpretations [United States vs. Oregon, Civ. 68-513 (D. Or); Washington vs. Washington State Commercial Passenger Fishing Vessel Association, 443 U. W. 687 (1979)] have clarified and defined the treaty rights concerning harvest habitat protection and fisheries management.

The tribe's treaty rights include an allocation to take up to 50 percent of the harvestable salmon and steelhead runs passing the tribe's usual and accustomed fishing places as well as a right to sufficient water quality and quantity to maintain these runs at harvestable levels.

The Nez Perce Tribe is the legal successor in interest to the Indian signatories of the treaty. The Nez Perce Tribal Executive Committee, under provision of the Nez Perce Code, enacts tribal laws applicable to members of the tribe. On- and off-reservation harvest regulations are recommended by the Nez Perce Fisheries Department, reviewed, and acted upon by the Fish and Wildlife Subcommittee, and passed by resolution of the Executive Committee.

7.7.3.2 Environmental Consequences

Indian owned land and water rights would not be affected by the flow augmentation scenarios. At this level of analysis, it is anticipated that none of the flow augmentation scenarios would have an effect on ITAs in the Payette River basin.

7.7.4 Salmon River Basin

7.7.4.1 Affected Environment

Several tribes have traditionally fished within the basin. By virtue of the treaty of 1855, the Nez Perce Tribe has the right to fish in usual and accustomed sites throughout the basin. The Shoshone-Bannock Tribes through the 1868 Fort Bridger Treaty have the right to hunt and fish on any unoccupied Federal lands. The extent of the Shoshone-Paiute Tribes fishing right remains unresolved pending anthropological and legal research and evaluation. Several court cases have established the scope and extent of the treaties and the subsequent rights possessed by tribal members.

7.7.4.2 Environmental Consequences

The No Augmentation scenario would have no effect on ITAs in the basin. Effects of the 1427i and 1427r scenario in the basin are to increase streamflows and water quality by reducing the amount of irrigated land. Any detectable effect on ITAs would be positive.

7.7.5 Grande Ronde River Basin

7.7.5.1 Affected Environment

The Confederated Tribes of the Umatilla Indian Reservation and the Nez Perce Tribe have utilized the fish resources of northeast Oregon for hundreds of years. The right to fish at usual and accustomed areas in the Grande Ronde River basin was secured by treaties signed with the United States in 1855 and upheld in subsequent court cases (ODFW, 1990).

Treaties with the tribes are similar in structure and form the basis for tribal involvement in fisheries management and planning in the basin. The treaty with the Umatilla Tribes is a legal document in which the confederated tribes gave up ownership of a vast territory of land extending from the lower Yakima River and along the mid-Columbia River to beyond the Blue Mountains into the Grande Ronde River drainage, south to the Powder River, west into the John Day River, and north into the Willow Creek drainage. Included within this territory are parts of the Snake, Imnaha, Tucannon, Burnt, and Malheur River drainages. In return, the Umatilla Tribes reserved the following, and other, rights: (1) the Umatilla Indian Reservation as a permanent homeland; (2) to maintain their own form of government and to make and enforce laws within their territorial jurisdiction; (3) the exclusive right to take fish in streams running through and bordering the reservation, as well as the right to fish at all other usual and accustomed sites in common with citizens of the United States (ODFW, 1990). Tribal members are entitled to fish both on and off the reservation throughout all parts of the main stem Columbia and Snake Rivers and in the

Umatilla, Grande Ronde, Walla Walla, Tucannon, Yakima, Imnaha, Powder, Burnt, Malheur, Willow Creek, and John Day drainages (ODFW, 1990). Note that the Umatilla Indian Reservation lies to the west and outside the Grande Ronde River.

7.7.5.2 Environmental Consequences

The No Augmentation scenario would have no effect on ITAs in this basin. Effects of the 1427i and 1427r scenario in the basin are to increase streamflows and water quality by reducing the amount of irrigated land. Any detectable effect on ITAs would be positive.

7.8 Recreation

The Snake River basin contains some of the most important and highly valued recreation resources in the Pacific Northwest; some of these resource have national prominence. Some river reaches and reservoirs are located within or near national parks, national forests, state parks, and local parks. Recreation resources afford a wide spectrum of recreation opportunities which have added to the quality of life and formed an important component of the regional economy. In addition, there are specially designated recreation areas, wildlife refuges, and trophy fisheries. Water resources are a recreation magnet in this arid region.

Time constraints of this analysis made it necessary to limit the analysis to Reclamation facilities and to focus on 11 representative reservoirs and river reaches. Other reservoirs and river reaches affected by flow augmentation operations could be expected to experience similar effects. C.J. Strike and Brownlee Reservoirs are important sites for recreation on the main stem Snake River but are not discussed because of a lack of readily available data. It can be assumed that recreation at these reservoirs would be affected by flow augmentation but neither a quantitative nor qualitative analysis is possible without additional data.

Reclamation acknowledges that other factors related to operations affect recreation activities, but those factors are not considered here due to the difficulty in accurately evaluating them. For this analysis, visitation in visitor-days is used as the marker of changes in recreation. Furthermore, this analysis assumes that most recreation occurs during the 5-month period of May through September and that most visits at reservoirs are water-dependent or water-related.

The recreation analysis is based on factors which can be accurately measured: streamflow, reservoir elevation, boat ramp access, boating feasibility, and fishing success. A range of target riverflows and specific reservoir elevations from May through September which permit access to recreation facilities were determined at representative recreation sites throughout the Snake River basin by inventorying existing information sources. A percentage of general distribution of use under current river/reservoir operations was developed for each of the recreation sites analyzed. Boat ramp access was the measurement criteria used to estimate the effect a change in operations would have on reservoir recreation visitation. Boat ramp access and the ability to boat and fish were the measurement criteria used to estimate the effects to river recreation visitation.

The hydrologic model of the No Augmentation scenario indicates minimal differences in storage at a few reservoirs in the basin from the Base Case scenario. Because of the minor differences in storage, recreation visitation at these reservoirs would not likely change from the Base Case scenario so an analysis of the No Augmentation scenario was not made.

7.8.1 Recreation Activities

7.8.1.1 Boating

Boating is one of the most popular water-dependent recreation activities. Lakes and reservoirs provide numerous flat-water recreation opportunities that include waterskiing, cruising, and fishing. Non-motorized boating, such as sailing and canoeing, represents a much smaller percentage of overall boating activity than motorized boating. Boating is supported by boat ramps, courtesy docks, and marinas. Most reservoirs have an operating marina.

During the summer months, waterskiing and personal water craft (jet ski) use are popular activities on most reservoirs and slack-water river reaches. These activities are normally enjoyed early in the recreation season when reservoirs are full. Reservoir drawdown and low river flows late in the recreation season often limit these activities. If drawdown and low river flows occur during the peak recreation season, these activities may be curtailed or eliminated.

Kayaking, canoeing, and scenic and whitewater rafting are the most popular boating activities on free-flowing streams; however, there is also motorized boating. Sections of the Snake, Payette, and Salmon Rivers are nationally renowned for whitewater opportunities. Reaches of the Henrys Fork, Payette, Boise, and Grande Ronde Rivers are known for scenic float trips. Hells Canyon National Recreation Area attracts both whitewater and jet boat enthusiasts from across the nation. The Henrys Fork has the only nationally designated water trail in the country reflecting the unique character and popularity of the scenic floating experience along this river (IWRB, 1996). Boating activities in the basin are dependent upon current Reclamation river/reservoir operations to maintain the quality and sustainability of resources and access to facilities. Whitewater rafting, scenic float trips, and fishing-related boating are the focus of a substantial outfitter and guide industry (USFS, 1996).

Whitewater boating requires a variety of flows to provide a broad range of recreational opportunities for operators of various skill levels. Generally, high spring flows provide challenges for advanced boaters. Moderate flows in the summer offer good river running for those wanting to improve their boating skills and those who enjoy a challenge. Low flows in the fall provide scenic floating experiences and fishing opportunities (Reclamation, 1996b). Changes in flow levels can change the recreation experience, the number of visitors served, and the whitewater skill level required.

7.8.1.2 Fishing

Fishing is one of the most popular recreation activities on the river system and provides an important boost to local economies. Fishing activities are also dependent upon current Reclamation river/reservoir operations to maintain the quality and sustainability of resources and access to facilities. River fishing tends to be widely dispersed in contrast to reservoir fishing. Fishing activity peaks in early summer after the spring runoff and remains significant through October. Some of the reservoirs at higher elevations (e.g., Cascade Reservoir and Jackson Lake) support ice fishing activities in the winter. The highest percentage of summer fishing on reservoirs is boat fishing, but there is also substantial shoreline fishing. Game fish species sought by anglers include anadromous fish as well as resident cold-water game fish such as trout and kokanee and warm-water game fish such as bass and perch. In the basin above Hells Canyon Dam, fishing for anadromous fish is confined to hatchery salmon and steelhead planted for a recreation fishery and sturgeon.

Many river reaches have high-quality fisheries. Reaches such as the South Fork Snake and Henrys Fork support high numbers of drift boats and other fishing-related boating. In past years, the Snake River below Palisades Dam and the South Fork Boise River have been included in Trout Unlimited's top 100 trout streams in the United States. The Snake River in Hells Canyon hosts renowned steelhead fisheries.

7.8.1.3 Camping, Viewing, and Day Use

Reservoirs and rivers are important destination recreation sites for a variety of water-related activities such as camping, viewing, and day use. Many campers choose their destination based on proximity to other recreation opportunities, particularly boating and fishing. Camping facilities have been developed at nearly all reservoirs and accessible river reaches to support overnight and day-use activities. Swimming is often associated with boating, camping, and picnicking. Almost all swimming occurs during the summer months when water and air temperatures are warmer.

The reservoirs and river corridors frame natural features to form majestic vistas. Numerous parks, roadside rest areas, and view points are located along highways so day-use visitors can take advantage of the visual resources. Viewing scenery and wildlife is a major component for many of the reservoir and river boating activities. Visitors are attracted to impressive natural features such as the Grand Teton Range, Shoshone Falls, Thousand Springs, Hells Canyon, and the Lower Salmon Gorge. Other points of interest include the dams and fish hatcheries. Many historic and prehistoric features are located along the shores of the Snake River and its tributaries. Evidence of the Oregon Trail, the Lewis and Clark Trail, and early pioneer settlements can be found along the river reaches.

Forests, riparian areas, and wetland communities are often the focus of recreational interest or activities, especially in the arid regions. Hunting and wildlife viewing are significant recreational activities in the basin.

7.8.2 Recreation Focus Reaches

Table 7-18 is an overview of the primary recreation resources at major reservoirs and along major river reaches prepared for SR^3 and adapted for use in this report. The table identifies the ratings (1-12) of those reaches that are considered to be most significant based on visitor use, uniqueness, and special designation (higher numbers equal higher ratings). The highlighted reservoirs and river reaches (M-number) were analyzed for this report.

Table 7-18 Selected Recreation Reaches (11 Focus Reaches Are Identified by Shading and Bolded M-#)

Major Reach	Subdivision		Recreation Diversity	Agency Designation	Public Concern	Unique Features	Score*
1. Snake River	1.1 **M-1**	Jackson Lake	Fishing, camping, viewing, picnicking, motorized boating, non-motorized boating, sailing, water skiing, winter use	Grand Teton National Park-NPS	International	Scenic and unparalleled views of the Teton mountain range, wildlife viewing, geologic features	12
	1.2 **M-2**	Jackson Lake Dam to Moose	Fishing, camping, viewing, non-motorized boating	Grand Teton National Park, Bald Eagle Management Area-NPS	National/ International	Scenic and wildlife viewing	10
	1.3 **M-2**	Moose to South Park	Fishing, camping, viewing, hunting, picnicking, non-motorized boating	Eligible Wild and Scenic River - USFS	Regional	Scenic and wildlife viewing	10
	1.4 **M-2**	South Park to East Table	Fishing, camping, viewing, hunting, picnicking, non-motorized boating	Eligible Wild and Scenic River - USFS	National	Scenic and wildlife viewing, white water character	10
	1.5	East Table to Palisades Reservoir	Viewing, non-motorized boating	Eligible Wild and Scenic River - USFS	National	White water character, canyon geology	9
	1.6 **M-3**	Palisades Reservoir	Fishing, camping, viewing, hunting, picnicking, non-motorized boating, motorized boating, swimming, water skiing, trails, sailing	Snake River Area of Critical Environmental Concern - BLM	Regional	Scenery - fall colors with aspens, cottonwood, and pines	9
	1.7 **M-4**	Palisades Dam to Irwin	Fishing, camping, viewing, hunting, picnicking, non-motorized boating, motorized boating, trails	Snake River Area of Critical Environmental Concern - BLM, Eligible Wild and Scenic River - USFS/BLM, Proposed as State Recreational. River - IWRB	National/ International	Quality of cutthroat trout fishing (considered one of the top 100 trout streams in USA), scenery, Fall Creek falls, cottonwood gallery, bald eagles	10
	1.8	Conant Valley to Black Canyon	Fishing, camping, viewing, hunting, picnicking, non-motorized boating, motorized boating, trails	Snake River Area of Critical Environmental Concern - BLM, Eligible Wild and Scenic River - USFS/BLM, Proposed as State Recreational River - IWRB	National	Unroaded canyon, bald eagles, quality cutthroat fishing (considered one of the top 100 trout stream in USA), scenic values, cottonwood gallery, geology	11
	1.9	Black Canyon to Henrys Fork	Fishing, camping, viewing, hunting, picnicking, non-motorized boating, motorized boating	Snake River Area of Critical Environmental Concern- BLM, Eligible Wild & Scenic River - USFS/BLM, Proposed as State Recreational River - IWRB	National	Quality cutthroat fishery (considered one of the top 100 trout streams in the USA), scenic values, bald eagles and other wildlife viewing opportunities	10
2. Henrys Fork	2.1	Henrys Lake	Fishing, camping, viewing, hunting, picnicking, non-motorized boating, motorized boating,	Quality trophy fishery and wild trout management - IDFG, Henrys Lake State Park-IDPR, Fremont County Park	National	Tremendous fishery, trophy fish and fish habitat	10
	2.2	Henrys Lake Dam to Island Park Reservoir	Fishing, camping, viewing, hunting, picnicking, non-motorized boating	National Recreation Water Trail - USFS, State Recreational River - IWRB, National Natural Landmark-NPS	National	Fishing opportunities, trophy fish and fish habitat, scenic values, wildlife viewing, geologic springs	11
	2.3	Island Park	Fishing, camping, viewing, hunting,		Local	Wildlife viewing	8

Table 7-18 Selected Recreation Reaches (11 Focus Reaches Are Identified by Shading and Bolded M-#)

Major Reach	Subdivision		Recreation Diversity	Agency Designation	Public Concern	Unique Features	Score*
		Reservoir	picnicking, non-motorized boating, motorized boating, sailing				
	2.4	Island Park Dam to Snake River main stem	Fishing, camping, viewing, hunting, picnicking, non-motorized boating	State Natural and Recreational River - IWRB, Harriman State Park -IDPR, Scenic Byway -USFS	National	Blue ribbon fishery, Sheep Falls, Upper and Lower Mesa Falls, Box Canyon, canyon geology, scenic viewing, wildlife viewing	11
3. Willow Creek/Ririe Lake – Not evaluated							
4. Snake River	4.1	Henrys Fork to Shelly	Fishing, viewing, hunting, picnicking, non-motorized boating, motorized boating, Idaho Falls green belt	City parks- Idaho Falls	Local	Idaho Falls, white water slalom course	4
	4.2	Shelly to American Falls Reservoir	Fishing, viewing, hunting	Fort Hall Indian Reservation	National	Fort Hall Bottoms, cottonwood gallery, geologic springs	8
	4.3 **M-5**	American Falls Reservoir	Fishing, camping, viewing, hunting, picnicking, non-motorized boating, motorized boating, sailing, swimming, water skiing, trails	National Migratory Bird Flyway - USFWS, Sportsman park - County	Regional	Wildlife viewing, paleontology	7
	4.4	American Falls Dam to Milner Reservoir	Fishing, camping, viewing, hunting, picnicking, non-motorized boating, motorized boating, sailing, swimming, trails	Minidoka National Wildlife Refuge - USFWS, Massacre Rocks State Park, Lake Walcott State Park -IDPR, City and County parks, National Historic Trail - NPS	Regional	Wildlife viewing, geologic and historic features	8
	4.5	Milner Reservoir	Fishing, camping, viewing, picnicking, non-motorized boating, motorized boating	Milner Historic Site - BLM, National Historic Trail - NPS	Local	Historic features - Oregon Trail, dams	5
55. Snake River	5.1	Milner Dam to Twin Falls	Fishing, camping, viewing, picnicking, non-motorized boating, trails	Eligible Wild and Scenic River - BLM, State Recreational River - IWRB, Proposed National Historic District - NPS, Snake River Rim Special Recreation Mgt. Area - BLM, Caldron Linn Nat. Reg - NPS,	Regional	Star Falls, geology and scenic values of river canyon, class V white water character at Milner by-pass	9
	5.3	Twin Falls Reservoir and Dam (includes Twin Falls)	Fishing, viewing, picnicking, non-motorized boating, motorized boating, water skiing	Snake River Rim Special Recreation Mgt Area - BLM	Local	Canyon geology and scenery, Twin Falls, historic features	7
	5.4	Shoshone Falls Reservoir and Dam (does not include Shoshone Falls)	Fishing, viewing, picnicking, non-motorized boating, motorized boating, water skiing	Snake River Rim Special Recreation Management Area - BLM	Local	Canyon geology and scenery	7
	5.5	Shoshone Falls to Crystal Springs (includes Shoshone Falls)	Fishing, viewing, hunting, picnicking, non-motorized boating, motorized boating, swimming, trails	State Recreational River - IWRB, Snake River Rim Special Recreation Management Area - BLM, National Register Site-NPS, National Natural Landmark- NPS, City and County	National	Pillar and Auger Falls, Shoshone Falls, "Niagara of the West," canyon geology and scenery, historic features	12

Table 7-18 Selected Recreation Reaches (11 Focus Reaches Are Identified by Shading and Bolded M-#)

Major Reach	Subdivision		Recreation Diversity	Agency Designation	Public Concern	Unique Features	Score*
				parks			
	5.6	Crystal Springs to Lower Salmon Falls Dam	Fishing, camping, viewing, hunting, picnicking, non-motorized boating, motorized boating, water skiing, trails, swimming, sailing	Box Canyon ACEC- BLM, Niagara Springs Natural Landmark, Hagerman Fossil Beds Natl. Monument - NPS, Hagerman Wildlife Mgt Area- IDFG, Thousand Springs Scenic Byway- IDT, State Recreational River - IWRB, Niagra Springs State Park -	Regional	Geologic springs, paleontology, wildlife viewing, rapids, historic features	11
	5.7	Lower Salmon Falls Dam to Bliss Dam	Fishing, hunting, picnicking, non-motorized boating, motorized boating	Eligible Wild and Scenic River - BLM, State Recreational River - IWRB	Local	Sturgeon fishing, one of few reaches in Idaho that can be boated year round. Frank Lloyd Wright House on Rim	8
	5.8	Bliss Dam to C.J. Strike Reservoir	Fishing, viewing, hunting, picnicking, non-motorized boating,	Snake River Birds of Prey Conservation Area - BLM, C.J. Strike Wildlife Mgt Area - IDFG, National Historic Trail - NPS, Three Island State Park - IDPR	Local	Sturgeon fishing, historic features, raptor viewing	7
	5.9	C.J. Strike Reservoir	Fishing, camping, viewing, hunting, picnicking, non-motorized boating, motorized boating, sailing	Snake River Birds of Prey National Conservation Area - BLM, C.J. Strike Wildlife Mgt Area - IDFG, National Historic Trail - NPS	Local	Geologic and historic features, waterfowl viewing	8
	5.10	C.J. Strike Dam to Noble Island	Fishing, camping, viewing, hunting, picnicking, non-motorized boating, motorized boating, swimming, trails	Snake River Birds of Prey National Conservation Area- BLM, Black Butte-Guffy Butte National Archaeological District- NPS, Ted Trueblood Wildlife Mgt Area - IDFG, National Register of Historic Places -NPS, Celebration Park -County	Regional	Largest concentration of nesting raptors in the world, geologic, pre-historic, and historic features	10
	5.11 Noble Island to Boise River– Not Evaluated						
	5.12 Boise River to Brownlee Reservoir– Not Evaluated						
	5.13 Brownlee Reservoir– Not Evaluated						
6. Little Wood Reservoir/ Little Wood River – Not Evaluated							
7. Boise River	7.1	Anderson Ranch Reservoir	Fishing, camping, picnicking, viewing, hunting, motorized boating, water skiing		Regional	Not Evaluated	
	7.2	Anderson Ranch Dam to Arrowrock Reservoir	Fishing, viewing, picnicking, non-motorized boating	State Recreational River-IWRB, Eligible Wild and Scenic River-USFS	National	High valued fishery, canyon, roadless, rated top 100 streams in U.S. by Trout Unlimited, geology	10
	7.3	Arrowrock Reservoir	Fishing, viewing, picnicking, non-motorized boating, motorized boating, water skiing		Local		4
	7.4 **M-6**	Lucky Peak Lake	Fishing, camping, picnicking, viewing, motorized boating, non-motorized	State Park - Spring Shores Marina-IDPR, Wildlife Management Area-IDFG	Regional	Proximity to city	9

Table 7-18 Selected Recreation Reaches (11 Focus Reaches Are Identified by Shading and Bolded M-#)

Major Reach	Subdivision		Recreation Diversity	Agency Designation	Public Concern	Unique Features	Score*
			boating, water skiing, sailing, swimming				
	7.5 **M-7**	Lucky Peak Dam to Glenwood Bridge	Fishing, picnicking, viewing, non-motorized boating, Boise greenbelt trail	Discovery Park-Corps, Eagle Island, County, Ann Morrison Park, Julia Davis Park -City, Barber Park-County	Local	Greenbelt, wildlife viewing, proximity to city	10
	7.6	Boise River-Glenwood Bridge to Snake River – Not Evaluated					
	7.7	Lake Lowell	Fishing, picnicking, viewing, hunting, motorized boating, water skiing, non-motorized boating, winter use	Deer Flat National Wildlife Refuge -USFWS	Local	National Wildlife Refuge	8
8. Payette River	8.1 **M-8**	Cascade Reservoir	Fishing, camping, viewing, hunting, picnicking, non-motorized boating, motorized boating, swimming, sailing, water skiing	Six proposed Wildlife Management Areas - USBR/USFWS, Cascade State Park-IDPR	Regional		10
	8.2 **M-9**	N.F. from Cascade Dam to Cabarton	Fishing, camping, viewing, picnicking, non-motorized boating, swimming	Payette River Special Recreation Management Area - BLM	Local	Canyon, roadless character	7
	8.3 **M-9**	N.F. from Cabarton to Smiths Ferry	Fishing, non-motorized boating	State Recreational River - IWRB, Payette River Special Recreation Management Area - BLM	National/ International	Wildlife	9
	8.4	N.F. from Smiths Ferry to Banks	Fishing, camping, viewing, picnicking, non-motorized boating	State Recreational River - IWRB, Eligible Wild and Scenic River - USFS, Payette River Special Recreation Management Area - BLM	National/ International	Whitewater skill level	9
	8.5 **M-10**	Banks to Horseshoe Bend	Fishing, camping, viewing, picnicking, non-motorized boating, motorized boating	State Recreational River - IWRB, Eligible Wild and Scenic River- USFS, Payette River Special Recreation Management Area - BLM	National		8
	8.6	Horseshoe Bend to Black Canyon Reservoir– Not Evaluated					
	8.7	Black Canyon Reservoir	Fishing, sailing, picnicking, viewing, hunting, motorized boating, water skiing	Montour Cooperative Wildlife Management Area - USBR/IDFG	Regional		5
	8.8	Black Canyon Dam to Snake River	Fishing, picnicking, viewing, hunting, motorized boating, non-motorized boating	Birding Island Wildlife Management Area - IDFG, Payette River Wildlife Management Area - IDFG	Local		6
	8.9	Deadwood Reservoir	Fishing, camping, viewing, picnicking, non-motorized boating, motorized boating		Regional		5
	8.10	Deadwood River from Deadwood Dam to S.F. Payette River	Fishing, non-motorized boating	Eligible Wild and Scenic River- USFS, Wild Trout Management - IDFG	Regional	Natural, roadless, whitewater, hot springs	9
	8.11	S.F. Payette River from Deadwood	Fishing, camping, viewing, picnicking, non-motorized boating	State Recreational River - IWRB, Eligible Wild and Scenic River - USFS, Payette River	National	Big Falls, Canyon, high outfitter use, hot springs	10

Table 7-18 Selected Recreation Reaches (11 Focus Reaches Are Identified by Shading and Bolded M-#)

Major Reach	Subdivision		Recreation Diversity	Agency Designation	Public Concern	Unique Features	Score*
		River to M.F. Payette River		Special Recreation Management Area - BLM			
	8.12	Middle Fork to North Fork (Banks)	Fishing, camping, viewing, picnicking, non-motorized boating	State Recreational River - IWRB, Payette Special Recreation Management Area - BLM	National	Whitewater character, Staircase rapids, hot springs	10
9. Owyhee River	9.1 **M-11**	Lake Owyhee	Fishing, camping, picnicking, viewing, hunting, motorized boating, water skiing, swimming, sailing, non-motorized boating	Owyhee State Park-ODPR, Honeycombs ACEC, Special Recreation Management Area-BLM	Regional	Dam and glory hole, scenery, geology, wildlife, fishing, historical cemetery, petroglyphs, hot springs	11
	9.2	Owyhee Dam to Snake River	Fishing, camping, picnicking, viewing, hunting	Wild and Scenic River designation, watchable wildlife area, Recreation Management Area-BLM	Local	Scenery, wildlife, hot springs, blue ribbon fishing for brown trout, cottonwood riparian area, geology	12
10. Malheur River	10.1	Warm Springs Reservoir	Fishing, camping, non-motorized boating	Eligible Wild and Scenic River - BLM	Local	Wildlife viewing, big horn sheep	4
	10.2	Warm Springs Dam to Juntura	Fishing, camping, hunting, non-motorized boating	Suitable Wild and Scenic River - BLM	Local	Wildlife viewing	6
	10.3	Juntura to Snake River	Fishing, viewing, hunting, non-motorized boating	Wilderness study area- BLM	Local	Scenic viewing, hot springs	7
	10.4	Beulah Reservoir	Fishing, hunting, motorized boating, water skiing		Local		4
	10.5	Beulah Reservoir to Juntura	Fishing, camping, picnicking,		Local		7
11. Burnt River	11.1	Unity Reservoir	Motorized boating, fishing, sailing, camping	Oregon State Recreation Area	Local		([1])
	11.2	Unity Dam to Snake River			Local		([1])
12. Powder River	12.1	Phillips Lake	Boating (motorized and non-motorized), fishing, camping, picnicking, swimming, water-skiing, sailing, hiking, scenic viewing		Local		([1])
	12.2	Mason Dam to Thief Valley Reservoir			Local		([1])
	12.3	Thief Valley Reservoir	Boating (motorized and non-motorized), fishing, camping, picnicking, scenic viewing, water-skiing		Local		([1])
	12.4	Thief Valley Dam to Brownlee	Fishing, scenic and wildlife viewing, camping	Wild and Scenic River	Local	Significant trout fishery	([1])

Table 7-18 Selected Recreation Reaches (11 Focus Reaches Are Identified by Shading and Bolded M-#)

Major Reach	Subdivision		Recreation Diversity	Agency Designation	Public Concern	Unique Features	Score*
		Reservoir					
13. Snake River	13.1	Brownlee Dam to Oxbow Reservoir	Fishing, camping, scenic viewing		Regional		([1])
	13.2	Oxbow Reservoir	Boating, fishing, camping				([1])
	13.3	Hells Canyon Reservoir	Boating, fishing, camping				([1])
	13.4	Hells Canyon Dam to Lower Granite Lake	Boating (motorized and non-motorized), fishing, camping, hiking, scenic and wildlife viewing, hunting, hiking	Hells Canyon National Recreation Area, Hells Canyon State Park, Wild and Scenic River	National	Deepest gorge in North America, cultural/ historic sites, scenic viewing	([1])
	13.5	Lower Granite Lake	Motorized boating, camping, hiking, swimming		Local		([1])
14.Salmon River			Boating (motorized and non-motorized), fishing, camping, swimming, hiking, scenic and wildlife viewing, hunting, hiking	Eligible Wild and Scenic River-BLM	National	Significant Steelhead fishery; popular whitewater runs; cultural/historic sites (e.g. Lewis and Clark Trail, Chinese settlements, native Indian sites)	([1])
15. Clearwater River			Boating (motorized and non-motorized), fishing, swimming, camping, hiking, scenic viewing	Dworshak State Park (off of main stem, on NF Clearwater)	National	International reputation for Steelhead fishery	([1])
16. Grande Ronde River			Boating (motorized and non-motorized), fishing, swimming, camping, picnicking, hiking, scenic and wildlife viewing	Hilgard Junction State Recreation Area; Red Bridge State Wayside	Local		([1])

[1]Not evaluated

7.8.3 Snake River Upstream of Milner Dam

7.8.3.1 Affected Environment

7.8.3.1.1 Jackson Lake

Jackson Lake in Teton National Park is located at a higher elevation than any other reservoir in the basin. At full pool, the surface area of the lake is 25,500 acres. Grand Teton National Park is part of the Greater Yellowstone Ecosystem, an area designated as one of 337 world-wide Biosphere Reserves established by the United Nations Education, Scientific, and Cultural Organization. In addition, Grand Teton and Yellowstone National Parks have long been recognized as "Crown Jewels" of the National Park system, receiving millions of visitors annually. Given the international, national, and regional importance of the area which surrounds Jackson Lake, it is recognized as an extremely important recreation resource.

Jackson Lake has numerous recreational facilities along its eastern shoreline, including two lodges, three marina complexes, three campground areas, and several canoe areas, hiking trails, scenic overlooks, and picnic areas. The western shore is undeveloped providing opportunities for wilderness camping, hiking, and boating (Reclamation, 1996b). Approximately 298,000 people visit Jackson Lake annually. The area receives visitors from all over the world .

Power boating, jet skiing, sailing, windsurfing, canoeing, row boating, and kayak touring are popular activities. Approximately 400 private boats owned by local residents are kept on the reservoir throughout the summer season. Reservoir concessions rented boats to approximately 13,000 visitors in 1996 and provide docking facilities for 64 boats at Colter Bay and 2,750 other boat mooring sites. The Grand Teton Lodge Company hosts 16,000 patrons annually on scenic boat cruises.

The primary concerns on the lake occur at lower water levels. The income potential for Grand Teton Lodge Company is severely impacted when lake levels drop below 6755 feet. At this level, the scenic tour boats cannot safely navigate the narrow entrance to Colter Bay and the floating docks located on Elk Island become unusable. Shallow water in the reservoir renders the docks unusable without boat damage and the gas pump becomes inaccessible. At elevation 6751 feet, the boat ramp becomes unusable. These lake levels were reached in 1994 and resulted in a 20 percent reduction in revenues for Colter Bay Marina. Leeks Marina would be impacted next and Signal Mountain would not be affected until levels drop below 6740 feet.

Aesthetics is another major concern in the northern and eastern segment of the lake during low water. Mud flats that appear at low water levels detract from the view of the Teton Range. The area to the east is adjacent to Jackson Lake Lodge, the primary resort on the lake. Over 100,000 visitors are housed during the summer season. Access to back country sites on the west shore is completely cut off at low water levels.

A 1991 Wyoming Game and Fish Department Creel Survey indicates an estimated 20,560 anglers fished 75,662 hours on the reservoir from May through September. An additional 6,548 anglers ice fished for 31,238 hours during the winter. The primary reservoir sport fishery is lake trout. Ice fishermen access the area by snow mobiles, cross country skis, and snow planes.

7.8.3.1.2 Snake River from Jackson Lake Dam to Palisades Reservoir

This reach of the Snake River extends approximately 69 miles. The river changes from a deep, slow-moving single channel to swifter, heavily-braided channels to a steep, single-channel whitewater canyon section. The Snake River runs through Grand Teton National Park and Bridger-Teton National Forest BLM lands, and private lands and receives visitors from all over the world. The Corps maintains a levee system between Moose and South Park (Reclamation, 1996b).

The heaviest recreational uses on the river are scenic raft floats and whitewater boating. Eight boat ramps provide access to the river between Moose and Sheep's Gulch. The whitewater section of the river in the Alpine Canyon area receives nearly 160,000 commercial boaters and nearly 40,000 private boaters annually. July and August are the two most popular boating months (Reclamation, 1996b). There are approximately 30 commercial guides operating on the river providing rafting, fishing, and instructional services.

Fishing is distributed throughout the system, but is most concentrated from Pacific Creek to Deadman's Bar and from Wilson to South Park. Fishing is done primarily from boats with bank fishermen making up only 25 percent of the anglers. Fifty-eight percent of all anglers used guide services in 1994, with 70 percent of all anglers using flies. The majority of anglers catch and release fish throughout this reach. The combined cutthroat trout catch rates for boat and bank anglers have decreased from 0.992 fish per hour in 1985 to 0.82 fish per hour in 1994. The number of anglers has steadily increased over the past 15 years with the highest concentration in September. Anglers are attracted to a 3-day "One-Fly" fishing contest held each year during the second weekend of September.

Periodic natural spring flushing of side channels and isolated ponds is considered of great benefit to the river system and recreational users. High flows clear debris from channels making them navigable. This increases the variety of fishing and wildlife viewing opportunities for scenic floaters. Higher flows provide more surface area and reduce conflicts among rafters and fishermen. Two boat ramps in Alpine Canyon become difficult to use when flows fall below 3,000 cfs, but rafters have been able to use the landings even at low water levels (Reclamation, 1996b).

7.8.3.1.3 Palisades Reservoir

Palisades Reservoir covers 16,150 surface acres at full pool, has 70 miles of shoreline, and is bordered by Targhee National Forest to the north and Caribou National Forest to the south. The reservoir receives 78 percent of its visitation from eastern Idaho residents and 10 percent from Wyoming residents. The most popular recreation activities in 1989 were pleasure boating (35 percent), boat fishing (34 percent), and waterskiing (30 percent) (USFS, 1989). More recent use of personal water craft (jet ski) has probably changed this combination.

Warm temperatures bring crowds that exceed the capacity of recreation facilities. Approximately 62,000 people visit Palisades Reservoir each year. The recreation carrying capacity of the reservoir declines throughout the recreation season as the reservoir level declines. Two developed boat ramp sites are heavily used as larger boats can be launched from these sites throughout the summer. Four other launch sites consist of old highway spurs or gravel pads which have limited parking and turn around areas, but are rendered unusable early in the season as the reservoir level drops. Winter recreation occurs on the reservoir even though the developed recreation sites close in the fall and are dormant throughout the winter. Ice fishing, cross-country skiing, and snowmobiling are popular winter activities promoted by area businesses (USFS, 1989). Hunting occurs throughout the region and is an important component of the economy of Grand and Swan Valleys.

Palisades Reservoir is considered one of the top flat-water fisheries in eastern Idaho. It supports cutthroat, lake trout, and brown trout populations. Angling hours have declined from 197,189 in 1980 to 22,506 in 1993 despite an increase in hourly catch rates from 0.30 fish per hour in 1980 to 0.35 fish per hour in 1993 (IDFG, 1993).

7.8.3.1.4 Snake River from Palisades Dam to Irwin

Flows of the main stem in this reach are regulated by releases from Palisades Dam. The river flows through one of the most extensive riparian cottonwood forests in the west (Idaho, 1975). National Forest lands border the south side of the river. There is some private home development. The north side of the river is mainly private; a few parcels of land are managed by BLM. Access to the river is maintained by BLM and the Forest Service (Reclamation, 1996b). Developed recreation facilities include campgrounds, boat access, and picnic facilities. Recreation use is concentrated around these facilities and day-use activities predominate. Approximately 225,000 recreation visits take place along this stream reach. The composition of recreation activities is: fishing (65 percent), camping (8 percent), picnicking (8 percent), boating (6 percent), sightseeing (5 percent), hunting (3 percent) and other (5 percent)(IWRB, 1996).

This river reach is world renowned for its native cutthroat fishery and is nationally recognized as one of the top 100 trout fishing streams in America (Pero and Yuskavitch, 1989). The fishing season begins late in June and extends into November. Estimated annual fishing has more than tripled from 53,676 hours in 1982 to 169,142 hours in 1996 (IWRB, 1996). The salmon fly hatch in early July brings anglers to this reach from across the country.

The fishing industry and supporting services provide the primary economic base (see chapter 6) for this rural region, and guided fishing trips have dominated the outfitting industry. Commercial guiding is managed by the BLM which allows only six companies to be permitted. No more than four boats are permitted on a particular section of the river per day. In 1994, 79 percent of the outfitted trips were for fishing, an increase of 24 percent from 1993 (Idaho Outfitters and Guides Licensing Board, 1995). In 1995, 5,877 individuals used the services of an outfitter in this area (IWRB, 1996). Anglers are primarily day users although the commercial outfitters do maintain base camps in the canyon for overnight trips.

Drift boats, rafts, canoes, and jet boats are commonly seen on the river. Use of personal water craft (jet ski) is also increasing. Motorized boating activity accounts for 20-40 percent of the boating use (IWRB, 1996). Four boat ramps provide access between Palisades Dam and Conant. Boat access at Conant received an estimated 36,267 visits in 1995 (IWRB, 1996). The area is primarily visited for fishing opportunities, but the number of scenic float trips is steadily increasing.

Flows affect the ability to conduct outfitted trips. An informal survey of outfitters indicated flows of 8,000-10,000 cfs are ideal for guided fishing trips. Maximum flow was identified as 15,000 cfs and the minimum flow was identified as 3,000 cfs. High or low flows limit angling success and the commercial marketability of guided trips. When flows are too high, angler pressure increases on other river reaches such as the Henrys Fork (IWRB, 1996).

Sustained high flows in 1995 severely impacted the fishing industry for the season. Large sections of the river eroded as much as 30 feet from the original shoreline. Log jams formed in the lower canyon from debris washed down by the high flows. The concern is not the high spring flush of the system but rather sustained levels of high flow (Reclamation, 1996b).

7.8.3.1.5 American Falls Reservoir

American Falls Reservoir, covering 57,669 surface acres with 100-miles of shoreline, is the largest Reclamation reservoir in the Snake River basin. The reservoir covers 57,669 surface acres and has 100 miles of shoreline. The climate is semi-arid with cold winters and hot, dry summers. American Falls Reservoir is relatively shallow (average depth of 50 feet); because of this, the water temperature tracks the ambient air temperature. Land ownership, other than Reclamation lands around the reservoir and the Fort Hall Indian Reservation at the upper end of the reservoir, is predominantly private. Reclamation manages 4,302 acres of land above the normal high waterline and 3,385 acres of land along the Snake River downstream of the reservoir.

There are approximately 185,000 visits annually to the reservoir. The reservoir is relatively shallow with an average depth of 50 feet; therefore, the water temperature tracks the ambient air temperature. The northeast end of the reservoir has a very shallow water depth. Mudflats are exposed during drawdown and form a wetland area referred to as the Fort Hall and Springfield Bottoms. The remaining shoreline is comprised of vertical cliffs up to 45 feet high, some of which are highly erodible and continuously retreating.

Maximum pool elevation is normally reached in late April or early May with irrigation deliveries beginning in April and continue into October. The reservoir water surface reaches an average low elevation of 4326 feet in September. There is no conservation pool requirement at American Falls Reservoir; therefore, the reservoir can be drawn down to the original river channel to meet irrigation demands. This occurred during drought conditions in 1977, in the late 1980s, and in the early 1990s.

Reclamation has recreation lease agreements with three entities around the reservoir: Bingham County, Seagull Bay Boat Club, and the city of American Falls. In addition there is Reclamation's American Falls Dam Visitors Center and day-use recreation area and Sportsman's Park, operated by Bingham County. Most visitors come from Bannock, Bingham, and Power Counties, but many visitors pass through the area on their way to Yellowstone National Park. The reservoir meets a large percentage of the local and regional recreation demand which has steadily increased at a slow rate over the past two decades. Recreation facilities include full-service campgrounds, picnic areas, boat docks and storage facilities, boat ramps, parking, sports fields, a restaurant, restrooms, showers, a dump station, and a laundry. Recreation activities include boating, fishing, swimming, camping, picnicking, windsurfing, sailing, water skiing (Reclamation, 1994b).

Visitation at the developed sites is dependent to a great extent on reservoir levels and the usability of boat launching facilities. Drought conditions limit boating accessibility early in the peak recreation season. When launching becomes difficult or impossible at the Seagull Bay boat ramp, recreationists switch to ramps at one of the other area. However, all ramps become unusable later in the season; the weather becomes hot and recreationists move to Palisades Reservoir and other higher-elevation reservoirs.

The heaviest use at Seagull Bay occurs from the beginning of April through July, or later if the water level permits and temperatures remain comfortable. The Seagull Bay boat ramp is the first facility to be affected by low reservoir levels and cannot be used when the reservoir is lower than elevation 4330 feet. Powerboats typically cannot use the ramp beginning in July, sailboats in mid-July, and small boats by the end of July. Peak use of the ramp occurs on weekends when up to 100 boats are launched. Weekday use of the ramp ranges from 5 to 10 boats.

Willow Bay receives the most use of the four recreation sites, but the boat launch usually closes in mid-July when the reservoir drops below elevation 4327 feet. Visitation to the marina drops drastically when the boat launch closes, but beach and day-use areas remain active until the water quality drops in the latter part of summer.

The Sportsman's Park recreation area is most heavily used from mid-June through mid-September. Over 200 people on weekend days commonly visit this area. As many as 25 boats are launched on weekdays and between 50 to 60 are launched per day on weekends. This boat ramp, at elevation 4322 feet, is typically the third to close due to low reservoir levels.

The boat launch near the dam (elevation 4312 feet) is heavily used as the ramp is accessible throughout normal to high-water supply years and it is accessible towards the end of the peak recreation season in low-water supply years. However, poor water quality discourages use of this launch area late in the season.

Fishing is an important recreation component at American Falls Reservoir. The main game fish species are rainbow trout, cutthroat trout, brown trout, yellow perch, and black crappie. Largemouth and smallmouth bass are also found. Most anglers fish the lower end of the reservoir from the dam to Seagull Bay and West Bay. A slightly larger percentage of anglers was found in a 1981 survey to fish the reservoir from boats (57 percent) than from the bank (43 percent) (Reclamation, 1994b). Between 20,000 and 30,000 anglers typically harvest an estimated 26,000 rainbow trout a year in approximately 125,000 angler hours (Reclamation, 1994b). Virtually all trout fishing is from boats and increases as fish populations become concentrated with declining reservoir levels. Creel census data indicate that most trout range in size from 1 to 2 pounds. Smaller trout are the product of the current years stocking program; the larger trout are carried over from the previous year. In low-water supply years, carryover of larger fish is generally poor.

7.8.3.2 Environmental Consequences

The single most important factor that affects recreation at reservoirs is the ability to launch boats because this directly affects boating, fishing, hunting, and waterskiing. Other activities that are indirectly affected by reservoir water levels are viewing, camping, and picnicking.

On rivers, the ability to launch boats, boatability, and fishability are the primary factors affecting recreation. Boatability refers to flow conditions that allow safe boating, and fishability refers to conditions that affect safe fishing and success in catching fish.

Water supply directly affects opportunity and the quality of recreational activities. More water in streams may produce benefits or adverse impacts for boating, fishing, camping, swimming and other day-use activities. Maintenance of riverflows during the high-use summer season, specifically July and August, would provide waves, hydraulics, and exciting rapids that satisfy some user groups such as kayakers and rafters. These same flows may also shorten boating trip times making it more economical for commercial outfitters (Reclamation, 1996b). However, other users such as novice boaters or those not wanting the higher risk may be excluded from reaches of the river.

Streamflows dramatically affect fish catch rates. Fishing could improve with higher flows, or rivers may become unfishable or access to the water could be impeded and boat launching become impossible. Those river reaches where fishing is the primary recreation activity would experience the greatest impacts with changes in flows. Increased flows, depending on the geomorphology of the river and other hydrologic conditions, may create dangerous flow conditions and wash out rapids and fishing holes.

Beaches may be inundated, eliminating dispersed camping or day-use opportunities, and higher flows could reduce water temperatures and the appeal for water contact activities such as swimming or wading.

Consistently high flows could improve general water quality. When water quality standards are not met, swimming and other full-body-contact activities and partial-contact activities (e.g., fishing) may be undesirable or even prohibited. Increased turbidity and algae can serve as a deterrent to recreation activity and reduce aesthetic values.

River flows lower than current operations could displace river enthusiasts of high-skill levels or those desiring a higher risk activity. The fishing activities could decrease due to increased water temperatures that exceed salmonid tolerances. Streamflows less than needed to operate boat ramps may result in water too shallow to safely boat, may reduce aesthetic appeal and fishing success, and generally reduce recreation opportunities.

Operational conditions that benefit or adversely affect wildlife resources and the sustainability of fish populations at reservoirs have a corresponding positive or negative effect on recreation activities. The ability to launch boats changes with reservoir level fluctuations and affects boating, fishing, hunting, waterskiing, and scenic viewing. Recreation, including activities restricted to the shoreline, is significantly reduced when reservoir levels fall below the boat launching facilities. However, reduced reservoir pools may concentrate fish populations and increase fishing success. Low reservoir levels for extended periods would be detrimental to the riparian habitat and the fishery.

For this analysis it was assumed that the recreation experience would be close to the same under the No Augmentation scenario as under the Base Case, so the No Augmentation scenario was not analyzed. This assumption was made because the magnitude of change between these scenarios appears to be slight and would be difficult to measure from a recreation perspective. Additional data and time would be required to better distinguish between these two scenarios.

7.8.3.2.1 Jackson Lake

Recreation visitation at Jackson Lake would remain unchanged except in September under the 1427i scenario as shown in table 7-19. Winter recreational use (ice fishing and snowmobiling) on Jackson Lake was not analyzed. Decreased boat ramp access under the 1427i scenario is the major cause for a projected decrease in visitation. Lower reservoir levels would minimally affect aesthetic quality if mud flats are exposed. However, exposure of mud flats could block access to back country sites on the western shore.

Table 7-19 Projected Visitation at Jackson Lake (Visitor-Days)

Month	Base Case and 1427r	1427i
May	14,900	14,900
June	59,600	59,600
July	104,300	104,300
August	89,400	89,400
September	29,800	28,310
Total	298,000	296,510

7.8.3.2.2 Snake River Near Moran

The 1427i and 1427r scenarios would have adverse impacts to recreation on this river reach. Under the 1427i scenario there would be a loss of boating access and losses to the commercial guide industry which makes up 58 percent of all angling in this reach. The small percentage of bank anglers that use this reach would not be able to offset the economic loss incurred by the commercial guide industry. Visitation under the 1427i is projected to decline 10 percent in May, 15 percent in August, and 20 percent in September. Under the 1427r scenario, visitation is projected to decline 5 percent in May and 15 percent in August and September. Projected visitation is summarized in table 7-20.

Table 7-20 Projected Visitation on Snake River Downstream of Jackson Lake Dam (Visitor-Days)

Month	Base Case	1427r	1427i
May	14,350	13,633	12,915
June	71,750	71,750	71,750
July	100,450	100,450	100,450
August	86,100	73,185	73,185
September	14,350	12,198	11,480
Total	287,000	271,215	269,780

7.8.3.2.3 Palisades Reservoir

The analysis of recreation at Palisades Reservoir is based on data for boat access at two of six boat ramps.

The only scenario to have an impact is the 1427i scenario. Reservoir drawdown would begin earlier in the year during the heaviest recreation use, reducing visitation as boat ramp access becomes increasingly difficult and facilities are overcrowded. A reduction in visitation would be expected beginning in July (10 percent) and increasing in August (15 percent) and September (20 percent). Table 7-21 summarizes projected visitation.

Table 7-21 Projected Visitation at Palisades Reservoir (Visitor-Days)

Month	Base Case and 1427r	1427i
May	3,100	3,100
June	9,300	9,300
July	21,700	19,530
August	21,700	18,445
September	6,200	4,960
Total	62,000	55,335

Although the 1427r scenario would result in somewhat higher reservoir levels in August and September (compared to the Base Case), the levels would not likely result in increased visitor use.

7.8.3.2.4 Snake River Downstream of Palisades Reservoir

Recreation in this reach would be adversely affected in July and August under the 1427i scenario. July and August flows would be higher and would limit access for boating and exceed safe flows for fishing. Visitation is projected to be reduced by 15 percent in July and by 5 percent in August. Projected visitation is summarized in table 7-22.

Table 7-22 Projected Visitation on the Snake River Downstream of Palisades Dam (Visitor-Days)

Month	Base Case and 1427r	1427i
May	14,075	14,075
June	56,300	56,300
July	84,450	71,783
August	70,375	66,856
September	56,300	56,300
Total	281,500	265,314

7.8.3.2.5 American Falls Reservoir

The 1427i scenario would have a significant adverse affect on recreation at American Falls Reservoir as reservoir drawdown from June through September would likely limit access early in the recreation season to the one boat ramp closest to the dam. Water quality and fisheries would also decline sharply. The quality of the recreation experience may decline to unacceptable levels for the majority of recreationists who may choose to relocate to other reservoirs. American Falls Reservoir would experience a 23 percent seasonal reduction in visitation. The reduction in visitation would be 10 percent in May, 20 in June and July, and 30 percent in August and September.

Reservoir levels under the 1427r scenario would generally exceed existing Base Case scenario water elevations. The drawdown would generally follow a similar schedule as current operations, and more water would be available for recreation later in the season. Recreation use would likely continue to decline moderately as the recreation season progresses as it does under current operations.

The effects on recreation are summarized in table 7-23.

Table 7-23 Projected Visitation at American Falls Reservoir (Visitor-Days)

Month	Base Case	1427i	1427r
May	18,500	16,650	17,575
June	27,750	22,200	24,975
July	64,750	51,800	61,513
August	64,750	45,325	58,275
September	9,250	6,475	7,863
Total	185,000	142,450	170,201

7.8.4 Boise River Basin

7.8.4.1 Affected Environment

7.8.4.1.1 Lucky Peak Lake

Lucky Peak Lake, a Corps facility, is the most popular recreation site within the Boise River system due to its close proximity to the city of Boise. It receives about 787,300 visits per year and 95 percent of the visits originate from Ada County. The reservoir is 12 miles long, has 45 miles of shoreline, and covers 3,019 acres at full pool. The primary recreation activities are: boating (29 percent), picnicking (26 percent), swimming (19 percent), fishing (15 percent), and waterskiing (11 percent). Lucky Peak Lake State Park, located just downstream from the dam, is the most heavily used State park in Idaho (Beck & Baird, 1993).

Lucky Peak Lake has produced excellent fall trout fishing during normal to high water supply years. Anglers spent an estimated 162,505 hours fishing at Lucky Peak Lake in the 1990-1991 fishing season. According to information provided by IDFG, the catch rate averages .31 fish per hour (Beck and Baird, 1993). The majority of hours expended (60 percent) are in the winter to spring period. Bank anglers comprise 57 percent of the total anglers; boaters, 39 percent; and ice anglers, 3 percent.

The optimum reservoir level for recreation purposes is the full pool elevation of 3055 feet. Boat launching access sites are particularly sensitive to drawdowns as many sites become inaccessible when the reservoir drops only 5 feet.

The Corps identified 10 major and 10 minor recreation areas along the shoreline. All of the sites are day use only. Six of the major sites are accessed by automobile and the remainder are accessible only by boat. The most heavily used recreation sites on the reservoir are Spring Shores Marina, Barclay Bay boat ramp, and Turner Gulch boat ramp. The reservoir is maintained at full pool during normal water supply years from Memorial Day through Labor Day. Barclay Bay and Robie Creek ramps typically are not operational until around the first of June, which is when the reservoir starts to recede due to irrigation releases. These two ramps, along with Macks Creek ramp, are inaccessible by mid-June. The shorter ramp at Spring Shores is dry by the first of July while the longer ramp continues to function until around the first of August. The reservoir surface acreage, visual resource, and user experience can be badly diminished by this time in dryer water years. The Turner Gulch ramp operates at the minimum reservoir pool and is, therefore, never dry. During low water supply years, most boat ramps can operate only until mid-July.

In a wet water year, the lake is full for about 2 months, from July 1 to September 1, actually less time near full pool than in a normal water year due to flood control operations and because high water is about 1 month later than a normal water year. With the exception of early June, the pool elevations are very good for boating until early September (Shalkey Walker Associates, Inc., 1995).

During drought years, the early drawdown substantially affects boating use. Barclay Bay, Robie, and Macks Creek ramps become inoperable early in a dry year. As the Barclay Bay ramp becomes inoperable and the Spring Shores ramp approaches this situation, use pressure increases on the Turner Gulch ramp. Boat-in access sites are particularly sensitive to drawdowns. Many of these sites become inaccessible when the lake drops only 5 feet.

7.8.4.1.2 Boise River Downstream of Boise Diversion Dam

Boise Diversion Dam is located about 3.5 miles downstream from Lucky Peak Dam. About 2 miles further downstream is Barber Park which is the starting point for a locally-renowned summer pastime of floating the Boise River. Here, river floaters launch inner tubes and rafts for the 5-mile float into the center of the city of Boise. The river flows through a protected riparian corridor along which Boise has developed five large urban parks, which are connected by the Greenbelt, an extremely popular pedestrian/bikepath which parallels the river from Lucky Peak Dam to Eagle Island.

Barber Park is a 22-acre fee-use park owned and maintained by Ada County. Facilities include a boat launch, concession stand where rafts and inner tubes are rented, a day-use park with facilities for group use, and parking for about 800 vehicles. The park accommodates over 10,000 river floaters per day in the summer months (Beck and Baird, 1993). Ann Morrison Park is the bottom end of the floatable section. After public schools start in the fall, floating drops to about 100 people per day. During the winter, watching bald eagles along the river near the park is popular.

Kayakers and canoeists float the river between April and June when flows are 1,500-3,000 cfs. This volume of flow forms a Class III rapid at a weir in downtown Boise which is appropriate for intermediate and advanced kayakers.

The river is a tremendous asset within Ada County and, along with the parks and Greenbelt, is a continuing source of community pride. Not only does the river offer a diverse range of recreational opportunities, it provides great aesthetic benefits. The Boise River Festival, which originally centered around the river in downtown Boise, is a multi-day celebration of the connection between the river and the community. The festival draws over 1 million people annually and provides a sizable economic contribution to the community. This annual festival takes place the last week of June.

The main stem Boise River is open to fishing year around and provides a popular put-and-take fishery. River management goals are to enhance the habitat, stock the river seasonally with fingerling brown trout and adult steelhead, stock catchable rainbow trout year around, screen diversions to prevent loss of large fish, and manage the river for a high density of anglers. A 1989 survey indicated 488 anglers spent 867 fishing hours and caught 302 fish at a rate of 0.35 fish per hour (IDFG, 1989; Beck & Baird, 1993).

7.8.4.2 Environmental Consequences

7.8.4.2.1 Lucky Peak Lake

Recreation at Lucky Peak Lake would be adversely affected in July, August, and September by the 1427i scenario. The quality of the recreation experience would decline to unacceptable levels for the majority of recreationists, and water quality and fisheries would decline sharply. Projected visitation (compared with the base case) would be 10 percent less in July, 40 percent less in August, and 50 percent less in September. The smaller surface area would constrict use, increase the possibility of user conflict, and severely impact user safety.

The 1427r scenario would result in boat ramp access similar to the Base Case.
The effects on reservoir visitation are summarized in table 7-24.

Table 7-24 Projected Visitation at Lucky Peak Lake (Visitor-Days)

Month	Base Case and 1427r	1427i
May	78,726	78,726
June	118,089	118,089
July	275,541	247,987
August	275,541	165,325
September	39,363	19,682
Total	787,260	629,809

7.8.4.2.2 Boise River Downstream of Boise River Diversion Dam

The 1427i and 1427r scenarios would adversely impact recreation, especially in August, the month receiving heaviest recreation use. Flows higher than the Base Case in May and June would have less impact mainly due to colder water temperatures and historically less use on the river. July flows under both the 1427i and 1427r scenarios would exceed 1,500 cfs (as measured at Glenwood Bridge) about 40 percent of the time, which represents a 25 percent increase over the Base Case scenario. The loss of safe recreational flows through Boise during the peak summer recreation season would represent significant impact and far-reaching effects to residents of the area as well as city and county recreation programs.

Overall adverse impact on recreation throughout this reach stems from the fact that flows under the Base Case are already at maximum levels for safe tubing. Higher flows in August for the 1427i and 1427r scenarios would appear to preclude safe recreation flows in nearly 60 percent of years of the 62-year period of analysis compared to the Base Case under which riverflows never exceed 1500 cfs in August. A 40 percent drop in use levels is estimated . Projected visitation is summarized in table 7-25.

Table 7-25 Projected Visitation on Boise River Downstream of Boise River Diversion Dam

Month	Base Case	1427i	1427r

May	17,500	8,750	9,975
June	17,500	8,750	8,750
July	87,500	64,750	64,750
August	175,000	75,250	70,000
September	52,500	52,500	52,500
Total	350,000	210,000	205,957

7.8.5 Payette River Basin

7.8.5.1 Affected Environment

7.8.5.1.1 Cascade Reservoir

Cascade Reservoir is located in the west-central mountains of Idaho, on the North Fork of the Payette River in Valley County. The economy of Valley County, Idaho is particularly dependent upon recreational resources. Two major reservoirs–Cascade and Deadwood Reservoirs–and Payette Lake provide boating, fishing, waterskiing, and other water-based recreational activities. The towns of Cascade (population 2,629) and McCall (population 1,181) are growing at the rate of 6 percent/year and are major destination resorts for regional residents and out-of-state visitors. Total employment within the county is 4,750 workers, with tourism supporting over 2,000 workers (42 percent of workers). The government sector employs an additional 1,000 workers, and agriculture supports 240 workers. Over 90 percent of the county is public lands. The region supports water-based sports, wildlife, and wilderness, and winter sports, making it a year-round recreation center.

The city of Cascade is near the south end of the reservoir; the city of Donnelly, near the north end. Reclamation administers a narrow strip of land of irregular width around most of the reservoir. Generally, the lands west of the reservoir away from the immediate shoreline are administered by the Boise National Forest. The remaining surrounding land is privately owned, except for isolated parcels of State and Federal lands. Cascade Reservoir has a surface of 28,300 acres at normal full pool which is 4828 feet. The reservoir is shallow; the average depth being only 26.5 feet. Since 1983, a 300,000-acre-foot minimum pool has been maintained. This results in a mean annual drawdown of 12 feet. Lowest water levels are typically reached in October; highest in June. At full pool, the reservoir is 21 miles long and has 86 miles of shoreline. The southern portion of the reservoir is wide and unsheltered from wind; the widest point being 4.5 miles.

The reservoir is situated in Long Valley, a broad valley with large areas of open grasslands and sagebrush which afford expansive views of the surrounding mountains. The reservoir receives most use from areas within a 2-2½ hour drive; this includes the city of Boise and Ada, Adams, Boise, Canyon, Gem, Payette, Valley and Washington Counties. Access is via U.S. Highway 55.

Recreation facilities are managed by IDPR/Reclamation, and USFS. Several private organizations lease land from Reclamation or the Forest Service. Reclamation and IDPR are in the process of transferring 11 Reclamation managed recreation sites to the Idaho State Park system. Camping is a secondary use to fishing, the primary recreation activity, but is the most significant use on Reclamation lands. Peak use begins in mid-May and ends when cold, wet weather arrives in September. The developed recreation sites are located around the reservoir and include picnicking facilities with tables and grills, boat ramps, campgrounds with drinking water, vault and flush toilets, and camping spurs with tables and grills. There are about 233 designated single and double campsites in campgrounds ranging from 12 to 42 individual

party campsites (Reclamation, 1991). There are 10 sites with public boat ramps around the reservoir which provide a total of 17 lanes. When the reservoir falls below 4812 feet, eight of the boat lanes are unusable. Elevation, slope, and water current limit the extension potential of the boat launches at Donnelly City Park, French Creek, Southwest Idaho Senior Citizens Recreation Association, and Morning Dawn (Reclamation, 1991).

Fishing is the primary recreation activity at Cascade Reservoir. It is estimated that the reservoir receives approximately 130,000 angler days of use per year. Fishing occurs throughout the reservoir and preferred fishing spots change with the seasons. Yellow perch is the most popular fish, followed by trout and salmon (Reclamation, 1991). Since 1995, however, the yellow perch population in Cascade Reservoir has been in significant decline and angling pressure is the lowest recorded in the 1980s and 1990s (IDFG, 1998). The poor fishing has caused a large drop in angler use of the reservoir and serious loss of economic value of the fishery.

There are 10 developed recreation sites around the reservoir with public boat ramps which provide a total of 17 boat launching lanes. Eight of the boat lanes are unusable when the water level falls below elevation 4812 feet.

7.8.5.1.2 North Fork Payette River Downstream of Cascade Dam

The Payette River is a major tributary of the Snake River draining about 3,240 square miles in west-central Idaho. Over 64 percent of the basin is public land. The Payette River is located about 45 minutes driving time from the Boise metropolitan area via State Highway 55. Flows on the North Fork Payette are controlled by releases from Cascade Reservoir. The flow gauge is located 0.2 miles downstream from Cascade Dam and about 6 miles upstream of Cabarton Bridge (IWRB, 1991).

Lands adjacent to the river are managed by the Boise National Forest, BLM, or privately owned. State Highway 55 parallels the river along much of its length. There are two distinct white water reaches and one flat water reach. Recreation activities on and along the river corridor include sightseeing, boating, fishing, swimming, camping, picnicking, berry picking and hunting.

The North Fork Payette River has one flat-water reach and the remainder can be split into two distinct whitewater reaches. Recreation activities on and along the river corridor include boating, fishing, sightseeing, swimming, camping, picnicking, berry picking, and hunting. Irrigation releases from Cascade Dam enhance mid- to late-summer boating on the North Fork.

The flat-water reach begins below Cascade Dam and extends down river to Cabarton Bridge. The river meanders through Long Valley, a broad, flat valley with interspersed summer home developments and agricultural lands. This section of river is valued for scenic floating by recreationists that use kayaks, rafts, drift boats, and canoes. Use has been fairly light, but interest in scenic river trips by canoe has been growing and will probably translate into greater use levels in the near future.

The North Fork is a whitewater boating attraction of regional, national, and international interest and has been designated as a Recreational River by the State of Idaho. The North Fork, in conjunction with the South Fork Payette River (not included in this analysis), forms a whitewater recreational complex with conditions ranging from relatively easy novice-class water to highly challenging water demanding expert boating skills (IWRB, 1991). The upper reach extends from Cabarton Bridge to Smiths Ferry. The reach from Smiths Ferry to Banks may be the most continuous stretch of whitewater in the world and is used primarily by kayaks and smaller catarafts. The Idaho Whitewater Association holds annual whitewater rodeos on the Payette River between Deer Creek and Banks which draws national and international boaters. The Idaho Department of Parks and Recreation (IDPR) found that participants in the 1990 rodeo

came from Idaho (29 percent), other states (68 percent), and from other countries (3 percent) (IWRB, 1991).

Outfitters use portions of the Payette River for commercial float trips. Eight outfitters are licensed by the Idaho Outfitters and Guides Licensing Board to operate on the North Fork, South Fork, and main stem of the Payette River. Five permits are granted by the USFS for four reaches including the North Fork from Cabarton Bridge to Smiths Ferry.

The North Fork fishery below Cascade Dam is supported by wild trout reproduction. Fishing accounts for about 8 percent of the use of the North Fork (IWRB, 1991). Recreationists spent an estimated total of 45,926 hours of use in 1980 along the North Fork. The fishery from Cabarton to Smiths Ferry is unique in west-central Idaho in that it provides an isolated wading stream fishery for wild rainbow trout. The catch rate is generally in excess of one fish per hour, and the population contains a significant portion of trophy size fish (Scully, 1987). Most fishing occurs at campgrounds and highway turn outs between Rainbow Bridge and Banks.

7.8.5.1.3 Payette River Downstream of Banks

The main stem of the Payette River from Banks to Horseshoe Bend is heavily used by private boaters and commercial outfitters. The primary recreation activity is whitewater rafting. The reach can be divided into a whitewater segment from Banks to Beehive Bend and a calmer water segment from Beehive Bend to Horseshoe Bend. The Banks to Beehive Bend reach has been designated as a Recreational River by the State of Idaho.

Jet boats use the main stem Payette River during spring flows; over 80 percent of the jet boaters are Idaho residents. The Western Whitewater Association, Inc. estimates use at more than 500 user-days per year. The Association sponsors club runs between Banks and Black Canyon Reservoir during periods of high runoff.

7.8.5.2 Environmental Consequences

7.8.5.2.1 Cascade Reservoir

The 1427i scenario would adversely impact recreation at Cascade Reservoir. Cascade Reservoir would experience heavy draw down for most of August and September. This would leave boat launch facilities unusable during the peak recreation season and would adversely impact the sport fishery. The recreation experience would likely drop to unacceptable levels for the majority of recreationists. Visitation would be reduced 10 percent in June, 15 percent in July, and 40 percent in August and September. Water quality, aesthetics, and reservoir fishing, all of which contribute significantly to the recreation experience at Cascade Reservoir, would be severely impacted. The local economy would suffer significant impacts as visitors would look to other lakes or reservoirs for recreation.

The 1427r scenario would impact recreation, but not as much as the 1427i scenario. The 300,000-acre-foot conservation pool would be maintained in September, but pool levels would be lower than with the Base Case. Visitors would experience more crowding around developed recreation facilities, and aesthetic appeal would likely be lost due to development of large mudflat areas. Water quality, an important factor at Cascade Reservoir, may also decline. Visitation would be reduced 10 percent in June and July and 5 percent in August. The projected effects on reservoir visitation are summarized in table 7-26.

Table 7-26 Projected Visitation at Cascade Reservoir (Visitor-Days)

Month	Base Case	1427i	1427r
May	22,500	22,500	22,500
June	67,500	60,750	60,750
July	157,500	133,875	141,750
August	157,500	94,500	149,625
September	45,000	27,000	45,000
Total	450,000	338,625	419,625

7.8.5.2.2 North Fork Payette River Below Cascade Dam

The North Fork Payette River whitewater reaches would be minimally affected under all scenarios. However, the 1427i or 1427r scenario would adversely affect more casual recreation such as fishing, floating, and canoeing. Under the 1427i scenario, visitation is likely to be decreased by 25 percent in September. Under the 1427r scenario, visitation in September would be down only 5 percent. Projected visitation is summarized in table 7-27.

Table 7-27 Projected Visitation on the North Fork Payette River (Visitor-Days)

Month	Base Case	1427i	1427r
May	410	410	410
June	1,640	1,640	1,640
July	2,460	2,460	2,460
August	2,460	2,460	2,460
September	1,230	923	1,169
Total	8,200	7,893	8,139

7.8.5.2.3 Payette River Downstream of Banks

None of the scenarios would have a measurable effect on recreation visitation along this river reach. However, a general change in the seasonal flow regime could result in displacement of various user groups or users with different boating skill levels. Generally, higher flows appeal to the highly skilled boater, but the general boating population out numbers the highly skilled boaters. Lower flows accommodate boaters of all skills, but appeal most to boaters with intermediate skills. The mix of users and magnitude of use may change. However, a more detailed analysis would be required to better quantify impacts.

7.8.6 Owyhee River Basin

7.8.6.1 Affected Environment

Lake Owyhee is located in eastern Oregon on the Owyhee River. The reservoir is long and narrow and trends north-south. At full pool, water covers 13,900 acres and the shoreline is about 150 miles long. At full pool the average depth is 81 feet. The Vale District, BLM, developed a Wild and Scenic River Management Plan for the Main, West Little, and North Fork Owyhee Rivers (BLM, 1993) which are upstream of Lake Owyhee. Within the main Owyhee River corridor, the BLM administers the 110 river miles upstream of Birch Creek and Reclamation manages the 10 river miles from Birch Creek downstream to the backwater of Lake Owyhee.

The area is isolated but the reservoir provides recreational opportunities on a regional basis. Recreational activities include camping, swimming, fishing, waterskiing, boating, and hunting. Visitors come from both Idaho and Oregon.

Public recreation sites with developed facilities are concentrated at the north end of the reservoir near Owyhee Dam. Developed sites include the Owyhee Dam/Glory Hole, Malheur County boat ramp, and Lake Owyhee State Park. The only developed public recreation facility located south of this area is Leslie Gulch.

The Owyhee Dam/Glory Hole site is a day-use area. Recreation facilities include interpretive signs, observation deck, and parking turnout space.

Malheur County maintains a one-lane boat ramp about ½-mile southeast of the dam. Associated facilities include parking on the opposite side of the road and portable vault toilets.

Lake Owyhee State Park is operated by the Oregon Department of Parks and Recreation. Recreation sites include Gordon Gulch and McCormack campground. Gordon Gulch is a day-use area with 14 picnic sites, restrooms, a four-lane boat ramp, and a parking area with 57 vehicle parking spaces and 24 boat trailer parking spaces. On occasion when campsites at the McCormack campground are full, campers are allowed to stay at Gordon Gulch.

McCormack campground is a fully developed day and overnight use area. Facilities include 43 camping spurs (33 tent sites and 10 RV sites with electrical hookups), picnic tables, restrooms, shower facilities, a boat ramp, and fish cleaning facilities. Fishing is the primary weekday activity and waterskiing is the primary weekend activity for park users.

Leslie Gulch is located approximately 35 miles south of the dam and managed by the BLM. The area is popular for vehicle-supported day and overnight recreational activities. Developed facilities include: two single-unit vault toilets, a two-lane concrete boat ramp, a gravel surfaced parking area for motor vehicles and boat trailers, and a large parking area for overnight use. The site is the final take-out for whitewater boaters on the Owyhee River.

The shoreline provides outstanding opportunities for primitive and unconfined recreation activities such as camping and hiking. There are a number of dispersed undeveloped sites which are popular among boat-in campers and day-use recreationists.

There are two cabin lease sites on the reservoir. The Dry Creek Arm subdivision has 17 cabin lease sites and is accessible by motorized vehicle or by boat, and the Fisherman's Cove Subdivision has 43 cabin lease sites and is accessible only by boat. There are 4 cabin leases on State lands.

Use tends to be evenly distributed throughout the summer months but has been steadily declining since 1971. The decline may in part be attributed to a decline in fish size and catch rates, and the conversion of Bully Creek Reservoir in 1973 to warmwater fish production which became the area's top crappie producer in 1980 (Reclamation, 1994a).

Another factor contributing to the decline in recreational use is the fluctuation in reservoir water surface elevation. The prolonged drought in the late 1980s-1990s resulted in a reservoir elevation in June 1992, of 2596-feet, 50-feet below the average elevation over the previous 12 years. Substantial drops in reservoir elevation have significant adverse effects on the quality of the recreation experience. As boat ramps become increasingly distance from the reservoir water surface, boat launch and retrieval operations become increasingly difficult. Additionally, the barren shoreline is unattractive, reducing the aesthetic quality of the area for picnicking, bank fishing, swimming, and other day-use activities (Reclamation, 1994a).

Use figures at the park typically coincide with fishing conditions at the reservoir. When angling success is good, visitation increases. According to recreation data collected by the Oregon State Parks Department, visitors primarily come from (in descending order); southwest Idaho (Ada County), Portland, and Ontario (Reclamation, 1994a). Water-based activities include fishing, motorized and whitewater boating, windsurfing, and swimming.

7.8.6.2 Environmental Consequences

The 1427i and 1427r scenarios would adversely affect recreation at Lake Owyhee. The 1427i scenario would draft the reservoir more quickly and deeper than under the Base Case. Loss of the Leslie Gulch boat ramp, the uppermost ramp on the reservoir, would preclude use of the upper end of the reservoir and have a highly negative impact on recreationists floating the river and accessing the Leslie Gulch area for take out of boats. Aesthetics, recreation facilities, water quality, and the quality of the fishery would all suffer. Oregon State Parks facilities would likely experience a decline in recreation use. Visitation to the reservoir is projected to decline 10 percent in May and June, 15 percent in July and August, and 5 percent in September.

Under the 1427r scenario, Lake Owyhee would be drawn down slightly faster than under the base case. An 8 percent seasonal reduction in visitation would occur. Visitation is projected to decline 10 percent in May through July and 5 percent in August.

Table 7-28 summarizes projected visitation at Lake Owyhee.

Table 7-28 Projected Visitation at Lake Owyhee (Visitor-Days)

Month	Base Case	1427i	1427r
May	19,600	17,640	17,640
June	24,500	22,050	22,050
July	19,600	16,660	17,640
August	19,600	16,660	18,620
September	14,700	13,965	14,700
Total	98,000	86,975	90,650

7.8.7 Summary of Recreation Effects

Table 7-29 summarizes the recreation analysis for all the flow augmentation scenarios with the Base Case considered to be 100 percent. The percent of seasonal change from the base case scenario is shown.

Table 7-29 Summary of Potential Summer Recreation Visitation (Percent Compared to Base Case)

Area	Base Case and No Augmentation	1427i	1427r
Jackson Lake	100	99	100
Palisades Reservoir	100	89	100
American Falls Reservoir	100	77	92
Lucky Peak Lake	100	80	100
Cascade Reservoir	100	75	93
Lake Owyhee	100	89	92
Snake River downstream of Jackson Lake Dam	100	86	94
Snake River downstream of Palisades Dam	100	94	100
Boise River downstream of Boise River Diversion Dam	100	25	18
NF Payette River downstream of Cascade Dam	100	96	99
Payette River downstream of Banks	100	100	100

Table 7-29 shows that the 1427i and 1427r scenario would result in the loss of some recreation and the loss would be far more widespread and greater in depth with the 1427i scenario than with the 1427r scenario. Recreation losses would be greater for the Boise River reach below Boise River Diversion Dam than for any other site. Other sites with loss greater than 20 percent include American Falls Reservoir, Cascade Reservoir, and Lucky Peak Lake. Overall, recreation losses would be greater under the 1427i scenario than the 1427r scenario at all but two sites.

The 11 recreation areas featured in this analysis were selected based on geographic and recreational diversity to show the general effects and can be used as an example of what could happen at other reservoirs and stream reaches. Some of the losses would likely be mitigated by recreationist moving to other sites for recreation. However, this could come at a price. Displaced use absorbed by other areas may result in overcrowding, increased user conflicts, damage to facilities, and deterioration of the site. Ultimately, the net effect would be loss of recreation experience and decline in the quality of the recreation experience. This analysis acknowledges that there is a link among recreation sites and uses, but that a quantitative analysis of this aspect is not feasible at this level of study.

7.9 Wild and Scenic Rivers

The Wild and Scenic Rivers Act of 1968 requires Federal agencies to consult with the appropriate managing agencies whenever proposed actions may affect a river designated, or identified as eligible or suitable for wild and scenic river designation.

> "(d)(1) In all planning for the use and development of water and related land resources, consideration shall be given by all Federal agencies involved to potential national wild, scenic and recreational river areas, and all river basin and project plan reports submitted to the Congress shall consider and discuss any such potentials. The Secretary of the Interior . . . ."

The listing and descriptions in this section are limited to those rivers reaches that could be affected by operation of Reclamation facilities or by private irrigation in those areas identified for potential purchase of water rights. The descriptions of the river reaches were taken from the 1992 River Information Digest published by American River Management Society, Western Region; the Wild and Scenic River Act of 1968; and appended materials from the Federal Government's Wild and Scenic Rivers Act Internet site. Some of the geographic terms used to describe the river reaches are incorrect or inconsistent with accepted standards so it is difficult to clearly identify the reach. These cases are noted with a comment printed in italics.

The various states have also applied state designations to specific river reaches including some of the reaches that are included in the National Wild and Scenic Rivers system. River reaches with state designations were not identified for this analysis.

7.9.1 Affected Environment

Rivers included in the National Wild and Scenic Rivers system are classified as a wild, scenic, or recreational river based upon the unique attributes and the amount of human encroachment and development that affects these rivers. Several river reaches in the Snake River basin are included in the National Wild and Scenic Rivers System and several other reaches are proposed for inclusion in the system. The description of some of these reaches is unclear and comments have been included where that is true. River reaches and their designation within the general area of analysis that are now part of the national system include:

- Snake River, main stem
  - The reach from Hells Canyon Dam downstream to Pittsburgh Landing (wild river)
  - The reach from Pittsburgh Landing downstream to the Willamette meridian (scenic river)

- Owyhee River
  - The South Fork from the Idaho-Oregon State line downstream to Three Forks (wild river) *(Comment: meaning is unclear as the South Fork confluence with the main stem (East Fork) is in Idaho and about 30 miles upstream from Three Forks)*
  - The North Fork from the Idaho-Oregon State line to the main stem (8 miles) (wild river)
  - The main stem from Three Forks downstream to China Gulch (wild river)
  - The main stem from Crooked Creek downstream to the Lake Owyhee (wild river)

- Salmon River, Middle Fork
  - Origin to the confluence with the main stem Salmon River.

- Salmon River, main stem
  - The reach from the North Fork to Corn Creek (46 miles) (recreational river)
  - The reach from Corn Creek to Long Tom Bar (79 miles) (wild river)

- Grande Ronde, main stem
  - From the Wallowa River to the Oregon-Washington State line (48 miles) (Some segments designated as wild, others as recreational)

The following river reaches have been identified for potential addition to the National Wild and Scenic Rivers system. Studies will be conducted by the appropriate managing agency to determine river reach eligibility and suitability for inclusion in the National Wild and Scenic Rivers system. Again, some of the river descriptions are not decipherable and comments have been included. These river reaches include:

- Snake River
  - Main stem, from the southern boundaries of Teton National Park to the entrance to Palisades Reservoir.
  - Main stem from an eastward extension of the north boundary of section 1, township 5 north, range 47 east, downstream to the town of Asotin, Washington.
  - South Fork *(Comment: the main stem is sometimes referred to as the South Fork)*, Palisades Dam to Heise and Heise to Menan
  - Main stem from Blackfoot to American Falls Reservoir
  - Main stem , Milner section
  - Main stem, Murtaugh to Twin Falls Dam
  - Main stem, Lower Salmon Falls Dam to Bliss and Bliss to King Hill

- Bruneau River
  - The entire main stem
  - West Fork from Rowland Nevada to Indian Hot Springs

- Owyhee River
  - South Fork, Oregon from the Oregon-Idaho border downstream to Owyhee Reservoir. *(Comment: description is incorrect, see comment above)*
  - East Fork from Garat Crossing to confluence of East and South Forks
  - Main Stem from South Fork/East Fork confluence to Oregon border (*Comment: East Fork Owyhee River in Idaho and Nevada is considered to be the main stem*)

7.9.2 Environmental Consequences

The flow augmentation scenarios would increase flows during the summer months and decrease flows during the winter months. This would more closely mimic the natural river system without any development. The No Augmentation scenario would have the opposite effect but would generally not be measurable. In most reaches now in the National Wild and Scenic Rivers system, these flow changes would be minor, but generally beneficial. Although a definitive analysis was not made, it is clear that the flow augmentation scenarios would have little or no effect on the status of river segments currently included in the National Wild and Scenic Rivers system.